PHYSICS

PAST PAPERS

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PHYSICS

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CONTENTS

OBJECTIVES (MCQ'S) OF CHAPTER-12 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Coulumb's Law:

1. **If the distance between two point charges is doubled, the force between them will become:** **(2 times)**
(A) Double (B) Half (C) Three times (D) One fourth
2. **The SI unit of constant 'K' in Coulomb's Law is:**
(A) Nm^2C^{-2} (B) $C^2N^{-1}m^{-2}$ (C) $C^2N^{-2}m^{-2}$ (D) $Nm^{-2}C^2$
3. **The electric force of repulsion between two electrons at a distance of 1m is**
(A) 1.SN (B) $1.5\times10^{-9}N$ (C) $2.30\times10^{-28}N$ (D) $2.30\times10^{-30}N$
4. NC^{-1} **is a unit of:**
(A) Force (B) Charge (C) Current (D) Electric intensity
5. **If the magnitude of charge and distance between them is doubled then force will be:**
(A) Doubled (B) Halved (C) Unaffected (D) One fourth
6. **Coulomb per volt is called:**
(A) Farad (B) Ampere (C) Joule (D) Ohm
7. **How many electrons will have a charge of one Coulomb:** **(6 times)**
(A) 6.2×10^{18} (B) 6.2×10^{19} (C) 5.2×10^{18} (D) 5.2×10^{19}
8. **When an insulating medium is placed between two charges, the electrostatic force is:**
(A) Increased (B) Zero (C) Decreased (D) same
9. **When a dielectric is placed between two charges, then coulomb's force will be:**
(A) Increased (B) Decreased (C) Zero (D) Negative
10. **Presence of dielectric always:** **(2 times)**
(A) Increases the electrostatic force (B) Decreases the electrostatic force
(C) Do not effect (D) Double the electrostatic force
11. **When dielectric material is placed in an electric field it:**
(A) Conducts (B) Exhibit electric charge
(C) Undergoes electrolysis (D) Becomes polarized
12. **Under the action of electric field, molecules of a dielectric:**
(A) Begin to vibrate (B) Become electric dipole (C) Are lionized (D) Are changed
13. **The force between two similar unit charges placed one meter apart in air is:**
(A) Zero (B) One Newton (C) 9×10^9N (D) 9×10^{19}N
14. **The constant of proportionality "K" depend upon:**
(A) Nature of charge bodies (B) The system of units
(C) Distance between the bodies (D) Nature of medium between two charges & system of units
15. **The value of ε_0 permittivity for free space is:** **(2 times)**
(A) $8.85\times10^{-12}\ C^2N^{-1}m^{-2}$ (B) $8.85\times10^{-12}\ Nm^2C^{-2}$
(C) $8.85\times10^{-12}\ NmC^{-2}$ (D) $8.85\times10^{-12}\ m^2N^{-1}m^2$
16. **The electrostatic force between two charges is 42N. If we place a dielectric of $\varepsilon_r = 2.1$ between the charges, then force become equal to:** **(3 times)**
a) 42 N (b) 88.2 N (c) 20 N (d) 2 N
17. **SI units of permittivity of free space are:**
a) $Nm^{-2}C^{-2}$ (b) $N^{-1}m^2C^{-1}$ (c) $C^2N^{-1}m^{-1}$ (d) $C^2N^{-1}m^{-2}$
18. **Relative permittivity for air is:** **(2 times)**
a) 1.06 (b) 1.006 (c) 1.0006 (d) 1.6
19. **The value of coulomb's constant (K) in SI unit is:**
a) $9\times10^9\ Nm^2C^{-2}$ (b) $9\times10^9\ NC^2m^{-2}$ (c) $9\times10^9\ N^{-1}m^2C^2$ (d) $9\times10^9\ Nm^2C^2$
20. **Force between two similar unit charges placed one meter apart in air is:**
A) One Newton (B) 9×10^9N (C) 9×10^{-9} (D) Zero Newton
21. **If the distance between two point charges is halved, the electric intensity becomes:**
A) half (B) $\frac{1}{4}$ times (C) double (D) 4 times

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السلام علیکم ورحمۃ اللہ وبرکاتہ:

معزز ممبران: آپ کا وٹس ایپ گروپ ایڈمن "**اردو بکس**" آپ سے مخاطب ہے۔

آپ تمام ممبران سے گزارش ہے کہ:

- گروپ میں صرف PDF کتب پوسٹ کی جاتی ہیں لہذا کتب کے متعلق اپنے کمنٹس / ریویوز ضرور دیں۔ گروپ میں بغیر ایڈمن کی اجازت کے کسی بھی قسم کی (اسلامی وغیر اسلامی، اخلاقی، تحریری) پوسٹ کرنا سختی سے منع ہے۔
- گروپ میں معزز، پڑھے لکھے، سلجھے ہوئے ممبرز موجود ہیں اخلاقیات کی پابندی کریں اور گروپ رولز کو فالو کریں بصورت دیگر معزز ممبرز کی بہتری کی خاطر ریموو کر دیا جائے گا۔
- کوئی بھی ممبر کسی بھی ممبر کو انباکس میں میسیج، مس کال، کال نہیں کرے گا۔ رپورٹ پر فوری ریموو کر کے کاروائی عمل میں لائے جائے گی۔
- ہمارے کسی بھی گروپ میں سیاسی و فرقہ واریت کی بحث کی قطعاً کوئی گنجائش نہیں ہے۔
- اگر کسی کو بھی گروپ کے متعلق کسی قسم کی شکایت یا تجویز کی صورت میں ایڈمن سے رابطہ کیجئے۔
- سب سے اہم بات:

گروپ میں کسی بھی قادیانی، مرزائی، احمدی، گستاخِ رسول، گستاخِ امہات المؤمنین، گستاخِ صحابہ و خلفائے راشدین حضرت ابو بکر صدیق، حضرت عمر فاروق، حضرت عثمان غنی، حضرت علی المرتضیٰ، حضرت حسنین کریمین رضوان اللہ تعالیٰ اجمعین، گستاخ اہلبیت یا ایسے غیر مسلم جو اسلام اور پاکستان کے خلاف پراپیگنڈا میں مصروف ہیں یا ان کے روحانی و ذہنی سپورٹرز کے لئے کوئی گنجائش نہیں ہے لہذا ایسے اشخاص بالکل بھی گروپ جوائن کرنے کی زحمت نہ کریں۔ معلوم ہونے پر فوراً ریموو کر دیا جائے گا۔

- تمام کتب انٹرنیٹ سے تلاش / ڈاؤنلوڈ کر کے **فری آف کاسٹ** وٹس ایپ گروپ میں شیئر کی جاتی ہیں۔ جو کتاب نہیں ملتی اس کے لئے معذرت کر لی جاتی ہے۔ جس میں محنت بھی صَرف ہوتی ہے لیکن ہمیں آپ سے صرف دعاؤں کی درخواست ہے۔
- عمران سیریز کے شوقین کیلئے علیحدہ سے عمران سیریز گروپ موجود ہے۔
- **لیڈیز کے لئے الگ گروپ کی سہولت موجود ہے جس کے لئے ویریفکیشن ضروری ہے۔**
- اردو کتب / عمران سیریز یا سٹڈی گروپ میں ایڈ ہونے کے لئے ایڈمن سے وٹس ایپ پر بذریعہ میسیج رابطہ کریں اور جواب کا انتظار فرمائیں۔ برائے مہربانی اخلاقیات کا خیال رکھتے ہوئے موبائل پر کال یا ایم ایس کرنے کی کوشش ہر گز نہ کریں۔ ورنہ گروپس سے تو ریموو کیا ہی جائے گا بلاک بھی کیا جائے گا۔

نوٹ: ہمارے کسی گروپ کی کوئی فیس نہیں ہے۔ سب فی سبیل اللہ ہے

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اللہ تبارک تعالیٰ ہم سب کا حامی و ناصر ہو

22. If the distance between the two charged bodies is halved, the force between them becomes: (2 times)
(A) Double (B) Half (C) Four times (D) One Fourth

Topic III: Electric Field Lines:

23. The SI unit of electric intensity is:
(A) NC^{-1} (B) Tesla (C) N/m (D) Coul/meter
24. Electric lines of forces are parallel and equally spaced, then electric field is:(2 times)
(A) Weak (B) Strong (C) Non-uniform (D) Uniform
25. The force experienced by unit positive charge placed at a point in an electric field is called:
(A) Coulomb's force (B) Faraday's force (C) Lorentz's force (D)Electric field intensity
26. A charge of $1\mu C$ experience a force of 10^{-6} N at a point then the electric intensity at that point is:
(A) $10^{6}NC^{-1}$ (B) $10^{-6}NC^{-1}$ (C) $10^{-12}NC^{-1}$ (D) $1NC^{-1}$
27. The lines which provide information about the electric force exerted on charged particles are:
(A) Magnetic field lines (B) Electric field lines (C) Tangent lines (D)Curved lines
28. The electric field lines are closer where the field is:
(A) Strong (B) Weak (C) Uniform (D) Variable
29. IF a charged body is moved against the electric field, it will gain: (2 times)
(A) P.E (B) K.E (C) Mechanical energy (D) Electrical potential energy
30. Special organ called Ampullae of lorenzini that are very sensitive to electric field are found in:
(A) Bats (B) Cats (C) Dogs (D) Sharks
31. The electric field created by positive charge is:- (2 times)
(a) Radially inward (b) Zero (c) Circular (d) radially outward
32. The unit of Electric intensity other than NC^{-1} is:- (2 times)
(a) V/A (b) V/m (c) V/C (d) N/V
33. Which one of the following can be taken as measure of electric field intensity:
(a) $\frac{F}{A}$ (b) $\frac{\phi_e}{A}$ (c) $\frac{qA}{\varepsilon_0}$ (d) $\frac{\phi\varepsilon_0}{A}$
34. The unit of Electric intensity other than NC^{-1}
(A) VA^{-1} (B) Vm^{-1} (C) VC^{-1} (D) NC
35. The idea for electric field lines was proposed
(A) Henry (B) Michael Faraday (C) Ampere (D) Ohm
36. The electric field intensity due to an infinite sheet of charge is: (2 times)
(A) $\overline{E}=\frac{\sigma}{2\varepsilon_o}\hat{r}$ (B) $\overline{E}=\frac{2\sigma}{\varepsilon_o}\hat{r}$ (C) $\overline{E}=\frac{1}{2\sigma\varepsilon_o}\hat{r}$ (D) $\overline{E}=\frac{\sigma}{\varepsilon_o}\hat{r}$
37. S.I unit of strength of electric field is:
(A) J/C (B) C/V (C) N/C (D) J/N
38. Closeness of the electric field lines is the measure of.
(A) Cirection of field (B) Strength of field (C) Potential difference (D) Uniformly of field
39. The direction of field lines around an isolated negative charge '-q' is.
(A) Radially inward (B) Radially outward (C) Elliptical (D) Circular
40. NC^{-1} is the SI unit of:
(A) Force (B) Charge (C) Current (D) Electric Intensity

Topic IV: Applications of Electrostatics:

41. An inkjet printer uses_____ in its operation:
(A) Positrons (B) Neutrons (C) An electric charge (D) Photons
42. Photocopier and inkjet are the applications of: (4 Time)
(A) Electronics (B) Electricity (C) Magnetism (D)Electrostatics
43. The word "Xerography" means: (2 times)
(A) Writing by left hand (B) Writing by children
(C) Dry writing (D) Writing by water colours

44. Identify the practical application of electrostatic: **(2 times)**
(A) Inkjet printer (B) X-rays (C) Laser (D) A.C Generator

45. An ECG records the ....between points on human skin generated by electric process in the heart: **(2 times)**
(A) Heart Beat (B) Pulse Rate (C) Pressure (D) Voltage

46. Selenium is a: **(3 times)**
(A) Conductor (B) Photoconductor (C) Insulator (D) Semiconductor

47. The number of protons in any atom is always equal to the number of:
(A) Neutrons (B) Electrons (C) Positrons (D) Mesons

48. Charge on an electron is:
(a) $1.6 \times 10^{-19}C$ (b) $1.6 \times 10^{+19}C$ (c) $9.1\times 10^{-19}C$ (d) $9.1 \times 10^{-27}C$

49. The drum in photo copier is coated with layer of: **(2 times)**
(A) Aluminium (B) Copper (C) Selenium (D) Silver

50. Which one is photo conductor: **(2 times)**
(A) Copper (B) Selenium (C) Mercury (D) Aluminum

51. Electro – Encephalo – Graphy (EEG) is the diagnostic test for the working of:
(A) Eye (B) Hear (C) Brain (D) Lungs

Topic V: Electric Flux:

52. If $\Phi_e = \vec{E}.\vec{A}$ then maximum value of flux is obtained if angle between $\vec{E}$ and $\vec{A}$ is: **(2 times)**
(A) 90° (B) 180° (C) 270° (D) 0°

53. SI unit of electric flux is: **(7 Time)**
(A) NC^{-1} (B) Nm^2C^{-1} (C) Tesla (D) Weber

54. Unit of energy density of electric field is:
(A) JC^{-1} (B) JV^{-1} (C) Jm^{-3} (D) JI^{-3}

55. When an area is held perpendicular to the field lines, then the magnitude of electric flux is:
(A) Negative (B) Maximum (C) Minimum (D) Zero

56. Electric flux through a closed surface does not depend upon: **(2 times)**
(A) Its shape (B) Medium (C) Charge (D) None

57. Energy density in case of a capacitor is always proportional to: **(2 times)**
(A) ε_o (B) C (C) V^2 (D) E^2

58. For computation of electric flux, the surface area should be:
(A) Parallel (B) curved (C) spherical (D) flat

59. Total flux through a closed surface depends on: **(2 times)**
(a) Shape of surface (b) Charge enclosed only
(c) Medium only (d) charge and medium

60. Electric-intensity inside the hollow sphere is:
(a) $\frac{\sigma}{\varepsilon_0}$ (b) $\frac{\sigma}{2\varepsilon_0}$ (c) $\frac{1}{\varepsilon_0}$ (d) Zero

Topic IX: Electric Potential:

61. The unit of electric charge is:
(A) Volt (B) Henry (C) Coulomb (D) Weber

62. Farad is the unit of:
(A) Charge (B) Current (C) Electric flux (D) Capacitance

63. A particle having 2e charge falls through a potential difference by 5v. Energy acquired by it is:
(A) 2.5 eV (B) 20 eV (C) 0.4 eV (D) 10 eV

64. Absolute potential difference due to point change of 1C at a distance of 1m is given by:
(A) 9×10^6 volts (B) 9×10^7 V (C) 9×10^8 V (D) 9×10^9 V

65. Two equal and opposite point charges separated by a distance 2m. The electric potential at the midway between them is:
(A) Zero (B) High (C) Low (D) constant

66. The relation "$\frac{\Delta V}{\Delta r}$" represents:
(A) Gauss's Law (B) Electrical flux (C) Electric intensity (D) Potential difference

67. If potential difference across two plates of a parallel plates capacitor is doubled then the energy stored in it will be:
(A) 2-times (B) 4-times (C) 8-times (D) remain same

68. The absolute Electric Potential at a point distant 20 cm from a charge of 2 μ c is:
(A) 9×10^2V (B) 9×10^3V (C) 9×10^4V (D) 9×10^5V

Topic X: Electron Volt:

69. Solid bodies are charged due to the transfer of:
(A) Electrons (B) Protons (C) Neutrons (D) All of these

70. 1 joule=______: (2 Time)
(A) 6.25×10^{18} eV (B) 6.25×10^{-18} eV (C) 1.6×10^{-19} eV (D) 9.1×10^{-31} eV

71. The electron volt is the unit of: (2 times)
(A) Electric current (B) Electric energy (C) Potential (D) Potential difference

72. One electron volt is equal to: (2 times)
(A) 1.6×10^{-19}Joul (B) 1.6×10^{19} Coulomb (C) 1.6×10^{-19} N (D) 1.6×10^{18}Joul

Topic XIII: Capacitor:

73. If potential difference across the two plates of a parallel plate capacitor is doubled then the energy stored in it will be: (2 times)
(A) 2 times (B) 8 times (C) 4 times (D) Remains constant

74. In R-C series circuit the correct relation for the time constant is:
(A) R.t = C (B) C.t = R (C) R.C = t (D) C.V = Q

75. The term 'RC' has same unit as that of:
(A) Potential (B) Capacitance (C) Energy (D) Time

76. Product of resistance and capacitance is called: (2 times)
(A) Gas constant (B) Resistivity (C) Boltzmann constant (D) Time constant

77. The amount of energy equal to 1.6×10^{-19} J is called: (2 times)
(A) One volt (B) One millivolt (C) One electron volt (D) One mega electron volt

78. The charging time of capacitor depends upon:
(A) R/C (B) C/R (C) RC (D) $\sqrt{RC}$

79. Farad is defined as:
(A) Coulomb/volt (B) Ampere/volt (C) Coulomb/joule (D) Volt/coulomb

80. A capacitor stores energy in the form of:
(A) Magnetic field (B) Heat energy (C) Electrical energy (D) Mechanical energy

81. The capacitance of a parallel plate capacitor in vacuum is:
(A) $C_{vac} = \frac{A\varepsilon_0}{d}$ (B) $C_{vac} = \frac{A\varepsilon_0\varepsilon_r}{d}$ (C) $C_{vac} = \frac{d\varepsilon_0}{A}$ (D) $C_{vac} = \frac{d\varepsilon_0\varepsilon_r}{A}$

82. The increase in capacitance of a capacitor due to presence of dielectric is due to _____ of dielectric:
(A) Electric polarization (B) Electrification (C) Ionization (D) Electrolysis

83. Capacitance of a capacitor does not depend upon:
(A) Distance between plates (B) Area of plates
(C) Electric field between plates (D) medium between plates

84. When dielectric is placed between the plates of capacitor, the value of E between the plates:
(A) Increases (B) Zero (C) Decreases (D) Infinite

85. If the separation between the plates of a capacitor is doubled then its capacitance becomes:
(A) Double (B) Half (C) One fourth (D) Three times

86. The product of resistance and capacitance is: (2 times)
(a) Velocity (b) Force (c) Acceleration (d) Time

87. The slope of (q-t) curve at any instant of time gives:
(A) $\frac{C^2}{Nm^2}$ (B) $\frac{C^{-2}}{Nm^2}$ (C) $Nm^{-2}C^{-1}$ (D) None of these

88. A capacitor is perfect insulator for
(A) Alternating current (B) Sparking current (C) Eddy current (D) Direct current

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89. The electric potential at a mid-point in an electric dipole is:
(a) 0 V (b) 0.5 V (c) 1 V (d) 1.5 V

90. If the distance between two charges is halved and charges are also doubled, then force between them will be:
(a) two times (b) four times (c) eight times (d) sixteen times

91. Coulomb per volt is called: **(2 times)**
(a) Farad (b) Ampere (c) Joule (d) Henry

92. If time constant is RC Circuit is small, than the capacitor is charged or discharged. **(3 times)**
(a) Slowly (b) Rapidly (c) at constant rate (d) intermittently

93. Gauss's law can only be applied to:
(a) A curved surface (b) A flat surface (c) A surface of any shape (d) A closed surface

94. Two oppositely charged balls A and B attract the third ball C, when placed near them turn by turn. The third ball C must be: **(2 times)**
(a) Positively charged (b) Negatively charged
(c) electrically neutral (d) Positively and negatively charged

95. The electric potential at a mid-point in an electric dipole is:
(A) 0 V (B) 0.5 V (C) 1 V (d) 1.5 V

96. In Millikan's oil drop experiment a charged particle of mass 'm' is in equilibrium in an applied electric field $\vec{E}$. If the direction of electric field is reversed then acceleration of the particle will be:
(A) zero (B) g/2 (C) g (D) 2g

97. Which material should be inserted between the plates of a capacitor in-order to increase its capacitance?
(A) copper (B) mica (C) iron (D) tin

98. The net charge on a capacitor (each plate haiving magnitude of charge q) is:
(A) infinity (B) 2 q (C) q/2 (D) zero

99. If electric and gravitational forces on an electron balance each other, then electric intensity will be:
(A) $E=\frac{mg}{q}$ (B) $E=\frac{q}{mg}$ (C) $E=\frac{F_e}{q}$ (D) $E=\frac{1}{4\pi\epsilon_0}\frac{q}{r^2}$

100. A charge of 4 Coulomb is in the filed of intensity 4 N/C. The force on the charge is: **(2 times)**
(A) 8 N (B) 16 N (C) 4 N (D) 1 N

101. The capacitance of capacitor depends upon:
(A) Thickness of plates (B) Charges on the plates
(C) Voltage applied (D) Geometry of the capacitor

102. A billion electrons are added to pith ball. It s charge is:
(A) -1.6×10^{-10}C (B) -1.6×10^{-12}C (C) -1.6×10^{-14}C (D) -1.6×10^{-7}C

103. Electric Flux is expressed as:
(A) $\phi_e=\vec{E}\times\vec{A}$ (B) $\phi_e=\vec{E}\,.\,\vec{Q}$ (C) $\phi_e=\vec{E}\,.\,\vec{A}$ (D) $\phi_e=EA^2$

104. The force between to charges is 28N. If Faraffin Wax of relative permittivity 2.8 is introduced between the charges as medium, then the force reduces to: **(2 times)**
(A) 25N (B) 20N (C) 15N (D) 10N

105. In case of photocopier, a special dry, black powder called toner is given a:
(A) Positive charge (B) negative charge (C) Neutral (D) First positive then negative

106. Drum of Photocopier is made of:
(A) Copper (B) Toner (C) Selenium (D) Aluminium

107. Intensity of field inside a hollow charged sphere will be:
(A) Negative (B) unaffected (C) zero (D) maximum

108. When some dielectric is inserted between the plates of a capacitor, then capacitance: (2 times)
(A) decreases (B) Increases (C) becomes zero (D) becomes infinity

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109. What is the force on a proton placed between two parallel plates containing equal positive charges:
(A) Zero (B) 2.6×10^{-19}N (C) 9×10^{-19}N (D) 5×10^{-19}N

110. Equation $\phi = \vec{E}.\vec{A}$ is applicatble to the surface.
(A) Cylindrical (B) Conical (C) Flat (D) Spherical

111. During danger the "eel" turns itself into a living battery then the potential difference between its head and tail can be up to:
(A) 160 V (B) 220 V (C) 440 V (D) 600 V

112. Due to polarization, electric field E in a capacitor:
(A) increases (B) decreases
(C) first increases then decreases (D) remains same

113. The charge on the Droplet in Millikan Experiment is calculated by using formula: (2 times)
(A) $q = \frac{mg}{vd}$ (B) $q = \frac{v}{mgd}$ (C) $q = \frac{mgd}{v}$ (D) $q = \frac{d}{mgd}$

114. 1 Ohm x 1 Farad is equal to:
(A) 1 Ampere (B) 1 Coulomb (C) 1 Joule (D) 1 Second

115. The study of electric charges at rest under the action of electric forces is known as:
(A) Electromagnetism (B) Electronstatics (C) Magnetic Induction (D) Electric field

116. A particle carrying a charge of 2e falls through a potential difference of 3V:
(A) 9.6×10^{-18} J (B) 9.6×10^{-19} J (C) 1.6×10^{-19} J (D) 9.6×10^{-17} J

117. The force on an electron in a field of 1×10^{8} NC^{-1} will be:
(A) 1.6×10^{-8}N (B) 1.6×10^{-11}N (C) 1.6×10^{-19}N (D) 1.6×10^{-27}N

118. A charge of 10^{-10} C between two parallel plates 1 cm apart experience a force of 10^{-5} N. The p.d. between the plates is:
(A) 10 V (B) 10^{2} V (C) 10^{3} V (D) 10^{4} V

119. The value of charge on 1.0×10^{7} electrons is:
(A) 1.6×10^{-12}C (B) $1.6\times10^{+11}$C (C) 1.6×10^{-19}C (D) $1.6\times10^{+19}$C

120. A rubber ball of radius 2cm has a charge of 5 μC on its surface, which is uniformly distributed the value of $\vec{E}$ at its centre is:
(A) $10NC^{-1}$ (B) Zero (C) 2.5 NC^{-1} (D) $5\times10^{-6}NC^{-1}$

2021

121. The force on electron in an electric field of magnitude $10^{4}NC^{-1}$ is:
(A) $1.9\times10^{-15}N$ (B) $1.6\times10^{-15}N$
(C) $1.6\times10^{-8}N$ (D) $1.8\times10^{-15}N$

122. The energy stored in the capacitor is:
(A) K.E (B) P.E (C) Electrical K.E (D) Electrical P.E

123. A particle of mass m and charge q is released from rest in a uniform electric field. The K.E attained by the particle after moving a distance 'd' is:
(A) $\frac{Ed}{q}$ (B) $qE^{2}d$ (C) qEd (D) $\frac{qE}{d^{2}}$

124. The statement $\phi_e = \frac{1}{\varepsilon_o}Q$ was given by :
(A) Farady (B) Dersted (C) Gauss (D) Coulomb

125. The negative sign in the expression of potential gradiant $\vec{E} = -\frac{\Delta V}{\Delta r}$ shows that, direction of $\vec{E}$ is along.
(A) Increasing potential (B) Decreasing potential
(C) Increasing strength (D) Negative potential

126. A particle of charge 2 e falls through potential difference of 3.0 V will have energy

(A) 1.5 eV (B) 0.66 eV (C) 6 eV (D) 12 eV

127. The minimum value of charge on free particle is

(A) $\frac{2}{3}e$ (B) $\frac{1}{3}e$ (C) $\frac{-2}{3}e$ (D) e

128. A capacitor is a device that can:

(A) generate charge (B) store charge
(C) neutralize charge (D) burn charge

129. Electric flux through a surface enclosing a charge depends on:

(A) charge only (B) medium only
(C) shape of closed surface (D) medium and charge enclosed

130. The quantity $-\frac{\Delta V}{\Delta r}$ is called:

(A) Electric potential (B) Electric energy (C) Potential energy (D) Potential gradient

131. The formula for electric field as potential gradient is:

(A) $E=\frac{-\Delta v}{\Delta r}$ (B) $E=\frac{-\Delta v}{\Delta t}$ (C) $E=\frac{-\Delta U}{\Delta r}$ (D) $E=\frac{-\Delta U}{\Delta t}$

132. The SI unit of electric potential is:

(A) $Kgm^2s^{-1}C$ (B) $Kgm^2s^{-2}C$ (C) $Kgm^2s^{-2}C^{-1}$ (D) $Kgm^{-2}s^2C^{-1}$

133. $\frac{sec}{ohm}$ is equal to:

(A) Coulomb (B) Farad (C) Joule (D) Ampere

134. Electrical field intensity between two oppositely charged parallel plates is:

(A) $\frac{2\sigma}{\varepsilon_o}$ (B) $\frac{\sigma}{\varepsilon_o}$ (C) $\frac{\sigma}{2\varepsilon_o}$ (D) $\frac{\varepsilon_o}{\sigma}$

135. When a dielectric material is inserted between the plates of a capacitor, the potential difference between the plates:

(A) Does not change (B) Increases
(C) Decreases (D) Increases then decreases

136. They energy stored in the capacitor is:

(A) K.E (B) P.E (C) Electrical K.E (D) Electrical P.E

137. The Gradient of the Scalar Field is always be a:

(A) Scalar Quantity (B) Vector Quantity (C) Variable Quantity (D) Fixed Quantity

138. On removing the dielectric from a charged capacitor its energy:

(A) Increases (B) Remains Unchanged (C) Decreases (D) None of these

139. A parallel plate capacitor with oil between the plate $(\varepsilon_r = 2)$ has a capacitance c. If the oil is removed then capacitance of capacitor becomes.

(A) C (B) $\frac{C}{2}$ (C) $\frac{C}{\sqrt{2}}$ (D) $\sqrt{2C}$

ANSWERS OF THE MULTIPLE CHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
D	A	C	D	C	A	A	C	B	B	D	B	C	D	A
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
C	D	C	A	B	D	C	A	D	D	D	B	A	D	D
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
D	B	B	B	B	A	C	B	A	D	C	D	C	A	D
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
B	B	A	C	B	C	D	D	C	B	A	D	D	D	D

61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
C	D	D	D	A	C	B	C	A	A	B	A	C	C	D
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
D	C	C	A	C	A	A	C	C	B	D	D	D	A	D
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
A	B	D	C	A	D	B	D	A	B	D	A	C	D	B
106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
D	C	B	A	C	D	B	C	D	B	B	B	C	A	B
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
B	D	C	C	B	C	D	B	D	D	A	C	B	B	C
136	137	138	139											
D	B	A	B											

SHORT QUESTIONS OF CHAPTER-12 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Coulomb's Law:

1. Describe the force on a positive point charge when placed between parallel plates with opposite and equal charges. **(7 Times)**

Ans: When a positive point charge is placed between parallel plates with opposite but equal amount of charge, then electric field intensity due to one plate is equal in magnitude but in same direction of the electric field intensity due to other plate. So the value of resultant electric field intensity is non-zero. Hence the point charge will be accelerated towards negative plate.

2. What is the effect of medium between the charges upon coulomb's force? Explain.

Ans: If an insulating material i.e. dielectric is placed between the charges, it will reduce the electrostatic force as compared to free space by factor ε_r called relative permittivity.

$$\mathbf{F} = \frac{1}{4\pi\varepsilon_0\varepsilon_r}\frac{q_1q_2}{r^2}\hat{r}$$

3. State Coulomb's law. Express its mathematical form.

Ans: It states that the force of attraction or repulsion between two point charges is directly proportional to the product of the magnitudes of charges and inversely proportional to the square of the distance between them.

Mathematically, if q_1 and q_2 be charges and distance between them is 'r' then,

$$\mathbf{F} = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}\hat{r}$$

4. Define electrostatics and electric force. **(2 times)**

Ans: <u>Electrostatics</u> The branch of physics which deals with the study of stationary charges is called electrostatics.

<u>Electric force</u> The force which holds the negative and positive charges that make up atoms or molecules is called electric force.

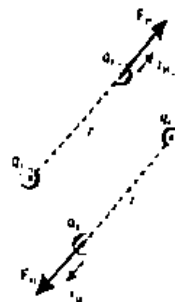
5. Prove that Coulomb's law obeys 3rd law of motion.

Ans: Let us have two charges as shown in figure.

From Coulomb's law

$$\vec{F}_{21} = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}\hat{r}_{21} \quad \text{______ (i)}$$

and
$$\vec{F}_{12} = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}\hat{r}_{12} \quad \text{______ (ii)}$$

From figure, it can be seen that $\hat{r}_{21} = -\hat{r}_{12}$

So, from equ. (i)

$$\vec{F}_{21} = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}(-\hat{r}_{12})$$

$$\vec{F}_{21} = -\frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}\hat{r}_{12}$$

Using equ. (ii)

$$\vec{F}_{21} = -\vec{F}_{12}$$

Hence proved that both the forces are equal in magnitude and opposite in direction.

Topic III: Electric Field Lines:

6. Write characteristics of electric field lines. (8 Times)
OR Write two properties of electric field lines.

Ans: i. Electric field lines originate from positive charges and end on negative charges.
ii. The tangent to a field line at any point gives the direction of the electric field intensity at that point.
iii. The lines are closer where the field is strong, the lines are farther apart where the field is weak.
iv. No two lines cross each other.

7. Electric lines of force never cross why? (25 times)
OR Comment on the uni-direction of electric lines of force.

Ans: Electric lines of force never cross each other. This is because that electric field line has only one direction at any given point. If the lines cross, electric Field lines could have more than one direction which is not possible.

8. If a point charge q of mass m is released in a non-uniform electric field with field lines pointing in the same directions, will it make a rectilinear motion? OR A point charge moves rectilinear path in an electric field. Explain. (10 Times)

Ans: If a point charge q of mass m is placed at any point in the field, it will follow straight or rectilinear path along the field line due to repulsive force.

9. Describe the force or forces on a positive point charge when placed between parallel plates, with similar and equal charges. (6 times)

Ans: When a positive point charge is placed between parallel plates with similar and equal charges, then the electric field intensity due to one plate is equal in magnitude but opposite in direction of electric intensity due to other plate. So the value of resultant electric field intensity E is zero. Hence the net force on the positive point charge is zero. Thus it will remain at rest.

10. Define electric intensity and give its unit.

Ans: The electrostatic force per unit test charge, at a specific point in the electric field, is called electric field intensity.

$$\vec{E} = \frac{\vec{F}}{q_0}$$

Its unit is NC^{-1}.

11. Distinguish between electric field and field intensity. (2 times)

Ans: <u>**Electric field:**</u>The space or region around the charge in which it exerts its eclectic force on other charges is called electric field.
<u>**Electric field Intensity:**</u>At any point in electric field the force experienced by a point charge q is termed as electric intensity or strength at that point.

12. Define electric field intensity. What is its unit and direction? (2 times)

Ans: Electric force applied per unit charge is called electric field intensity.
It SI unit is N/C.
Its direction is along the electric field i.e. from positive to negative plate.

13. How sharks locate their prey? Explain briefly.

Ans: Sharks have special organs, called the ampullae of Lorenzini, that are very sensitive to electric field and can detect potential difference of the order of nano volt and can locate their prey very precisely.

Topic IV: Applications of electrostatics:

14. What is photoconductor?

Ans: A material which behaves as an insulator when it is in dark and becomes conductor when it is exposed to light is known as photoconductor.

15. What is xerography? Name the heart of photo-copier.

Ans: xerography is a photocopying process. It is taken from the Greek word "xeros" and "graphos" which mean "dry writing".
The heart of machine is a drum which is an aluminium cylinder coated with a layer of selenium.

16. Explain briefly the role of deflection plates in inkjet printers.

Ans: An inkjet print head ejects a steady flow of ink droplets. The charging electrodes are used to charge the droplets that are not needed on the paper. Charged droplets are deflected into a gutter by the deflection plates while uncharged droplets fly straight onto the paper.

17 Define Electrostatics and Xerography.

Ans: The study of electric charges at rest under the action of electric forces is known as electrostatics.
Xerography is a photocopying process. It is from Greek word, "Xeros" and "graphos", meaning "dry writing".

Topic V: Electric Flux:

18. Define electric flux. Write its SI units. **(2 times)**

Ans: The number of the field lines passing through a certain element of area is known as electric flux through that area.

$$\Phi_e = \vec{E}.\vec{A}$$

Its SI unit is Nm^2C^{-1}.

19. Is E necessary zero inside a charged rubber balloon if balloon is spherical. Assume that charge is distributed uniformly over the surface? (11 Times)

Ans: Yes, $\vec{E}$ is necessarily zero inside a charged rubber balloon if balloon is spherical.

Since $\Phi_e = \frac{1}{\epsilon_0} \times Q$

If the Gaussian's surface is imagined inside charged balloon, then

$$Q = 0$$

It gives $\Phi_e = 0$

$$\vec{E}.\vec{A} = 0$$

Since $\vec{A} \neq 0$

So $\vec{E} = 0$

20. Does the total flux depend upon the shape or geometry of the closed surface?

Ans: No, the total flux does not depend upon the shape or geometry of the closed surface. It depends upon medium and charge enclosed.

21. What is the orientation of the surface in an electric field to get maximum flux through it?

Ans: When the surface area is held perpendicular to electric intensity the electric flux will be maximum.
In this case the electric field $\vec{E}$ and area vector $\vec{A}$ will be parallel. i.e. $\theta = 0°$.

$$\Phi_e = \vec{E}.\vec{A}$$
$$= EA\cos\theta$$
$$= EA\cos 0° = EA(1) = EA$$

22. Mention two situations of vector area in electric flux.

Ans: (i) If the electric field $\vec{E}$ and area vector $\vec{A}$ are parallel i.e. $\theta = 0°$ then the electric flux will be maximum.

$$\Phi_e = \vec{E}.\vec{A} = EA\cos\theta = EA\cos 0°$$
$$= EA(1) = EA$$

(ii) If the electric field $\vec{E}$ and area vector $\vec{A}$ are perpendicular i.e. $\theta = 90°$ then the electric flux will be zero.

$$\Phi_e = \vec{E}.\vec{A} = EA\cos\theta = EA\cos 90°$$
$$= EA(0) = 0$$

23. Define electric flux. Mention the factors upon which it depends. OR Upon what factors electric flux does depend? (2 times)

Ans: The number of the field lines passing through a certain element of area is known as **electric flux** through that area.

Electric flux depends upon the nature of medium and the charge enclosed.

24. Define electric force and electric flux.

Ans: The force which holds the positive and negative charges that make up atoms or molecules is called **electric force.**

The number of the electric field lines passing through a certain element of area is known as **electric flux** through that area.

Topic VII: Gauss's Law:

25. Give the statement of Gauss's law. Write down its mathematical form. (7 Times)

Ans: It states that the total electric flux through any closed surface is equal to $\frac{1}{\epsilon_0}$ times the total charge enclosed in it.

Mathematically,

$$\Phi_e = \frac{1}{\epsilon_0} \times Q$$

26. Suggest a method 'shield' an apparatus from electric field even when it is to be kept in the region where electric field is present. OR How a sensitive electric apparatus is shielded from electric field? (2 times)

Ans: An apparatus will be shielded from electric field when it is kept inside the metallic box, so that the charges will only reside on the outer surface of the container. It is in accordance with Gauss' law.

27. Is it true that Gauss's law states that the total number of lines of forces crossing any closed surface in the outward direction is proportional to the net positive charge enclosed within surface? (6 times)

Ans: Yes, the above statement is true. The total number of lines of force crossing any closed surface in the outward direction means electric flux.

Since

$$\Phi_e = \frac{1}{\epsilon_0} \times Q$$

$$\Phi_e = cosntant \times Q$$

$$\Phi_e \propto Q$$

$$electric\ flux \propto total\ positive\ charge$$

28. Define electric flux, Gaussian surface.

Ans: The number of electric field lines passing through a certain element of area is known as **electric flux** through that surface.

To apply Gauss's law, an imaginary closed surface is considered which passes through the point at which the electric intensity is to be evaluated. This closed surface is known as **Gaussian surface.**

Topic VIII: Applications of Gauss's Law:

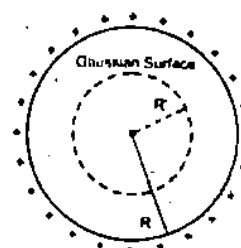
29. What is strength of electric field inside a hollow charged sphere and why?

Ans: The strength of electric field inside a hollow charged sphere is zero.

Since $\Phi_e = \frac{q}{\epsilon_0}$

$$\vec{E}.\vec{A} = \frac{q}{\epsilon_0}$$

Inside a hollow charged sphere $q = 0$

So $\vec{E}.\vec{A} = 0$, As $\vec{A} \neq 0$, Thus $\vec{E} = 0$

30. Define Gaussian surface and electric lines of force.

Ans: Applying Gauss's law, an imaginary closed surface is considered which passes through the point at which electric intensity is to be evaluated. This closed surfaces called **Gaussian Surface.**

Electric lines of force provide information about the direction and strength of the electric field at various places.

Topic IX: Electric Potential:

31. Do electrons tends to go to region of high potential or low potential? (27 Times)

Ans: Electrons tend to go to a region of high potential from low potential because electrons are negatively charged.

32. The potential is constant throughout a given region of space. Is electric field zero or non-zero in this region. (12 times)

OR Comment on electric field in region of constant potential.

Ans: The electric field will be zero in this region.

We know that electric field is equal to the negative of potential gradient

i.e

$$E = -\frac{\Delta V}{\Delta r}$$

Here in a present case

$$V = \text{constant}$$

So,

$$\Delta V = 0$$

Hence

$$E = -\frac{0}{\Delta r} = 0$$

33. Define electric potential and give its SI unit. (2 times)

Ans: The electric potential at any point in an electric field is equal to work done in bringing a unit positive charge from infinity to that point keeping it in equilibrium.

Its SI unit is volt (V).

Volt:

A potential difference of 1 volt exists between two points if work done in moving a unit positive charge from one point to other keeping equilibrium is 1 joule.

$$1\ volt = 1\frac{Joule}{1\ Coulomb}$$

34. What is difference between electrical potential energy and electrical potential difference? (3 times)

Ans: <u>**Electrical potential energy:**</u> The energy acquired by a unit positive charge in carrying it from one point to the other against the electric field keeping it in electrostatic equilibrium is called as potential energy.

It is the energy stored in the charge 'q' because of its position in an electric field. It is measured in joules.

<u>**Electrical potential difference:**</u> The electrical potential difference between two points is defined as the work done in carrying a unit positive charge from one point to the other point while keeping the charge in electrostatic equilibrium.

It is measured in volts.

35. What is Potential Gradient? OR Define Potential Gradient and give its unit? (4 times)

Ans: The quantity $(\frac{\Delta V}{\Delta r})$ gives the maximum value of rate of change of electric potential in magnitude and direction with respect to distance. It is known as potential gradient.

It's unit is Vm^{-1}

36. Why do the electrons tend to go to region of high potential?

Ans: We know that the electrons are negatively charged particles. So, when they are put inside an electric field they tend to go to the region of high potential (positive end) from the region of low potential (negative end).

37. What is meant by EEG and ERG? (3 times)

Ans: <u>**Electroencephalography (EEG)**</u> is usually applied over human brain to check its abnormal behaviour by the use of electrical energy. For this electrodes are connected to the selected portion of the head and the corresponding response is seen graphically through the screen of a recording device.

<u>**Electrocardiography (ECG)**</u> records the voltage between points on human skin generated by the electrical process in the heart. It is made in running position providing information about hearts performance under stress.

38. Define electric potential difference with units.

Ans: **Electrical potential difference:** The electrical potential difference between two points is defined as the work done in carrying a unit positive charge from one point to the other point while keeping the charge in electrostatic equilibrium.

Its SI unit is volt (V).

Volt: A potential difference of 1 volt exists between two points if work done in moving a unit positive charge from one point to other keeping equilibrium is 1 joule.

$$1\text{ volt} = \frac{1\text{ joule}}{1\text{ coulomb}}$$

39. Suppose that you follow an electric line due to a positive point charge. Do electric field intensity and the potential increase or decrease? (8 Times)

Ans: Since $E \propto \frac{1}{r^2}$

and $V \propto \frac{1}{r}$

So due to a positive point charge, both electric field and potential will decrease.

40. Show that $1\frac{volt}{metre} = 1\frac{newton}{coulomb}$ (9 times)

Ans: Since

$$1\frac{Volt}{meter} = 1\frac{Joule/Coulomb}{meter}$$

$$= 1\frac{Joule}{Coulomb \times meter}$$

$$= 1\frac{Newton \times meter}{Coulomb \times meter}$$

$$1\frac{volt}{metre} = 1\frac{newton}{coulomb}$$

Hence proved

41. Derive relation for potential gradient. / Show that $E = \frac{\Delta V}{\Delta r}$ (2 times)

Ans: The potential difference between two oppositely charged plates A and B is given as:

$$V_B - V_A = \frac{W_{AB}}{q_0}$$

Where

$$W_{AB} = Fd = -q_0 Ed$$

(negative sign shows that F is opposite to q_0E.)

So,

$$V_B - V_A = \frac{-q_0 Ed}{q_0}$$

Or

$$\Delta V = -Ed$$

Or

$$E = -\frac{\Delta V}{d}$$

If distance between the plates is infinitesimally small then

$$E = -\frac{\Delta V}{\Delta r}$$

The quantity $\frac{\Delta V}{\Delta r}$ is known as potential gradient.

42. A particle carrying a charge of 5e falls through a potential difference of 10.0V. What will be the energy acquired by it.

Ans:

$q = 5e$

$\Delta V = 10.0V$

$\Delta U = ?$

As we know that

$\Delta U = q\Delta V \quad = 5e \times 10.0V$

$= 50eV$

43. Differentiate between electrical potential difference and electric potential at a point.

Ans: The electrical potential difference between two points is defined as the work done in bringing a unit positive charge from one point to the other point while keeping the charge in equilibrium.
The electric potential at any point in an electric field is equal to work done in bringing a unit positive charge from infinity to that point while keeping the charge in equilibrium.

Topic X: Electron Volt:

44. Show that $1\,eV = 1.6 \times 10^{-19} J$ OR when the electrons fall through potential difference of one volt. Find its energy in electron volt. (6 times)

Ans: Since electron volt is the amount of the energy gained or lost by an electron as it traverses a 1 volt potential difference.

As
$$\Delta K.E. = q\Delta V$$
$$q = e = 1.6 \times 10^{-19}\ C$$
$$\Delta V = 1V$$

So,
$$\Delta K.E. = (1.6 \times 10^{-19} C)(1\ V)$$
$$1\ eV = 1.6 \times 10^{-19} CV$$
$$1\ eV = 1.6 \times 10^{-19} J$$

Hence proved

45. Define electron volt, give its mathematical form. (9 times)

Ans: The amount of energy acquired or lost by an electron as it us traversed by a potential difference of one volt.

As
$$\Delta K.E. = q\Delta V$$

So,
$$\because\ (1\ eV = 1.6 \times 10^{-19} J)$$

46. Convert 1 joule into electron-volt. (4 Times)

Ans: As
$$\Delta K.E. = q\Delta V$$
$$\because\ (q = e = 1.6 \times 10^{-19}\ C)$$
$$\Delta V = 1V$$

So,
$$\Delta K.E. = (1.6 \times 10^{-19} C)(1\ V)$$
$$1\ eV = 1.6 \times 10^{-19} CV$$
$$1\ eV = 1.6 \times 10^{-19} J$$

Now,
$$1\ J = \frac{1}{1.6 \times 10^{-19}}\ eV$$
$$1 J = 0.625 \times 10^{19}\ eV = 6.25 \times 10^{18}\ eV$$

47. A particle carrying a charge of 2e falls through a potential difference of 3.0V. Calculate the energy acquired by it. (4 Times)

Ans: It is given that
$$q = 2e$$
$$\Delta V = 3.0\ V$$

The energy acquired by the particle is
$$\Delta(K.E.) = q\Delta V$$
$$\Delta(K.E.) = (2e)(3V)$$
$$\Delta(K.E.) = 6\ eV$$
$$\Delta(K.E.) = 6 \times 1.6 \times 10^{-19} J$$
$$\Delta(K.E.) = 9.6 \times 10^{-19} J$$

48. When the electrons fall through a P.D of 1.0 Volt. Find its energy in electron volts.

Ans: As
$$\Delta K.E. = q\Delta V$$
$$q = e = 1.6 \times 10^{-19}\ C$$
$$\Delta V = 1V$$

So,
$$\Delta K.E. = (1.6 \times 10^{-19} C)(1\ V)$$
$$1\ eV = 1.6 \times 10^{-19} CV$$
$$1\ eV = 1.6 \times 10^{-19} J$$

Topic XI: Electric and Gravitational Forces:

49. Give similarity and difference between Coulomb and Gravitational forces.
OR Write any two differences between electric and gravitational force. (8 Times)

Ans: Similarities

I. Both forces are the conservative forces.
II. Both forces obey the inverse square law.

Differences

I. Electrical force is might be attractive as well as repulsive while the gravitational force is only attractive.
II. Electrostatic force is medium dependent while the gravitational force is not.

50. How the orbit of planets will be modified if planets were electrically charged?

Ans: It would add or subtract the gravitational force if the charge was large enough and the sun was charged. So the radius of the orbits would be changed.

51. Center of planetary system is oppositely charged to the rest of planets. How orbits of planets would be modified?

Ans: It would add the gravitational force if the charge was large enough and the sun was charged. So the radius of the orbits would be changed.

Topic XIII: Capacitor:

52. How can you identify that which plate of a capacitor is positively charged? (24 Times)

Ans: Gold leaf electroscope is used.
To check the polarity, disc of positively charged electroscope is brought close to the capacitor plate. If the divergence of gold leaves increases, the plate is positively charged and vice versa.

53. Define capacitance of a capacitor.

Ans: Capacitance is a measure of the ability of capacitor to store charge. OR
Capacitance of a capacitor can be defined as the amount of charge on one plate necessary to raise the potential of that plate by one volt with respect to the other.
The S.I unit of capacitance is Farad (F).

54. What is capacitor? Define the capacitance.

Ans: Capacitor is a device used to store charge.
Capacitance is a measure of ability of capacitor to store charge.

55. Define capacitance and its unit farad.

Ans: Capacitance is a measure of the ability of capacitor to store charge.
The capacitance of a capacitor is **one farad**. If a charge of one coulomb, given to one of the plates of a parallel plate capacitor, produces a potential difference of one volt between them.

56. Define capacitor and farad.

Ans: **A capacitor** is a device that is used to store charge.
The capacitance of a capacitor is **one farad** if a charge one coulomb, given to one of the plates of a parallel plate capacitor, produces a potential difference of one volt between them.

Topic XIV: Capacitance of parallel plate Capacitor:

57. Why does capacitance of a capacitor increase when a dielectric material is inserted between its plates? (2 Times)

Ans: When a dielectric material is inserted between the plates of a capacitor, the molecules of the dielectric under the action of electric force become dipoles and the dielectric is said to be polarized. It effectively decreases the surface density of charge(σ) on the plates due to which electric intensity between the plates ($E = \sigma/\varepsilon_o$) decreases and as a result potential difference($E = \frac{V}{d}$) decreases.
Capacitance of a capacitor is given by

$$C_{vac} = \frac{Q}{V}$$

Which clearly shows that with the decrease in potential difference, capacitance of a capacitor will increase.

58. How will capacitance of a parallel plate capacitor be affected if area of plates is doubled and separation between them is halved?

Ans: Since

$$C = \frac{A\varepsilon_0\varepsilon_r}{d}$$

By applying given condition

$$C_{new} = \frac{(2A)\varepsilon_0\varepsilon_r}{\frac{d}{2}}$$

$$C_{new} = 4\frac{A\varepsilon_0\varepsilon_r}{d}$$

$$C_{new} = 4C$$

So, the capacitance will increase four times.

59. Define dielectric constant and write its formula OR Define and write relation For dielectric constant in term of capacitance of a capacitor. (2 times)

Ans: Dielectric constant is defined as the ratio of the capacitance of a parallel plate capacitor with an insulating substance as medium between the plates to its capacitance with vacuum or air as medium between them.

$$\varepsilon_r = C_{med}/C_{vac}$$

Topic XV: Electric Polarization:

60. What is polarization and how dipoles are formed in dielectric?

Ans: The atoms and molecules in a dielectric (insulator) material are electrically neutral. The centers of positive (nucleus) and negative (electrons) charges coincide with each other.

When dielectric is placed between the plates of capacitor, positive and negative charges in the molecules of dielectric are displaced under the effect field. As a result, one end of molecules show a negative charge and the other end an equal amount of positive charge.

Thus the molecules become dipoles, the dielectric is said to be polarized and the process is called polarization.

61. What is Dipole?

Ans: Two equal and opposite charges separated by a small distance form a dipole. When a dipole is inserted between the plates of a capacitor, its molecules become dipoles under the effect of electric field.

62. What change takes place when polarization of dielectric occurs?

Ans: When a dielectric is placed in an external electric field, the charge arises as the result of redistribution of positive and negative charges within the dielectric.

63. Define electric polarization and electric dipole.

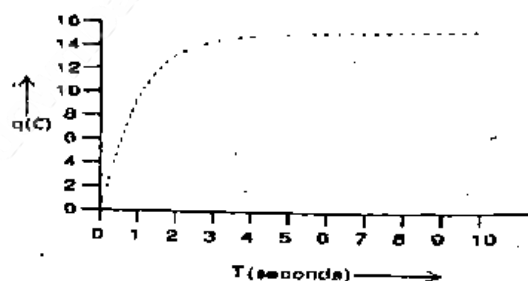
Ans: When dielectric is placed between the plates of capacitor, positive and negative charges of its molecules displace from their position. Positive charges are attracted towards negative plates and negative charges towards positive plate, dipoles are formed. This process is called **polarization.**

Two equal and opposite charges separated by a small distance is called a dipole.

Topic XVII: Charging and discharging of capacitor:

64. Define Time Constant for RC Circuit. Also draw (q-t) graph for charging of a capacitor in RC Circuit.

Ans: The time required by the capacitor to deposit 0.63 times the equilibrium charge q_o is called time constant. The product of R and C has the dimensions of time. So, this product is known as time constant.

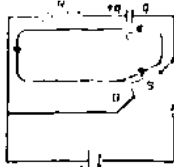
t = RC

65. How a capacitor is charged and discharged? Draw its R-C circuit.
OR Describe the process of charging and discharging in short. **(4 times)**

Ans: <u>Charging of a Capacitor</u>

When switch is set at point A, battery starts charging the capacitor through resistor.

$$q = CV_0\left(1 - e^{-\frac{t}{RC}}\right)$$

<u>Discharging of a Capacitor</u>

When switch is set at point B then charge $+q$ on the left plate can flow in anti-clockwise direction through the resistor and neutralize the charge $-q$ on the right plate.

How fast or how slow the capacitor is charging or discharging depends on the product RC, called time constant. Capacitor charges or discharges sooner when the time constant is small.

66. Verify that an ohm times Farad is equivalent to second. **(2 Times)**
OR Show that t = RC.
OR Prove that unit of series RC circuit is second.

Ans: Since $$V = IR$$

By putting $I = \frac{q}{t}$, we get $$V = \frac{q}{t}R$$

$$R = \frac{Vt}{q}$$

Since $$q = CV$$

So $$R = \frac{Vt}{CV}$$

$$R = \frac{t}{C} \quad , \quad RC = t.$$

In terms of units $ohm \times farad = second$

Hence it is proved that ohm times farad equals second.

67. What depend on the slow or fast charging and discharging of a capacitor?

Ans: How fast or how slow the capacitor is charging or discharging, depends upon the product of the resistance and the capacitance called time constant. $RC = t$
Capacitor is charged or discharged rapidly when RC is small.

68. What is time constant? **(4 Times)**

Ans: The time required by the capacitor to deposit 0.63 times the equilibrium charge q_o is called time constant.
The product of R and C has the dimensions of time. So, this product is known as time constant.

$$t = RC$$

If the time constant is small then the capacitor will be charged rapidly.

69. How much is the amount of charge at start of discharging of capacitor and start of charging of a capacitor.

Ans: Discharging begins at t = 0 when $q_o = CV_o$ and decreases gradually to zero.
At the start of charging q = 0 at t = 0 and increases gradually with time till it reaches its equilibrium value $q_o = CV_o$.

70. Define charging and discharging of a capacitor.

Ans: **Charging:** The R-C combination is connected to a battery which starts charging the capacitor through the resistor. The charges build up gradually to the equilibrium value.
Discharging: When battery is removed and R-C circuit is closed charge +q on one plate flows through the resistor and neutralize the charge −q on the other plate. Discharging begins and charge decreases gradually to zero.

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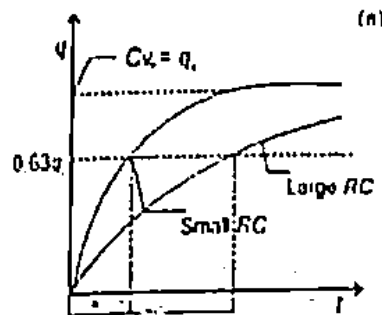
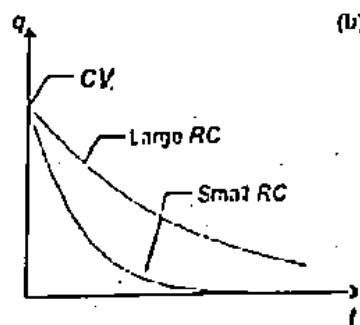
71. Sketch the graphs of charging and discharging of a capacitor.

Ans: The capacitor is not charged immediately, rather charges built up gradually to the equilibrium value $q_o = CV_o$. The growth of charge with time is shown in the graph (a) According to the graph, q = 0 at t = 0 and increases gradually with time till it reaches the equilibrium value $q_o = CV_o$.

Graph (b) shows the discharging of a capacitor through resistor. The graph shows that discharging begins at t = 0 when $q = CV_o$ and decreases gradually to zero.

72. Give a comparison of electric and gravitational force.

Ans:

Electric Force	Gravitational Force
i. Electric force is a conservative force.	i. It is also a conservative force.
ii. It is inversely proportional to the square of distance i.e, $F = K\frac{q_1q_2}{r^2}$ $F \propto \frac{1}{r^2}$	ii. It is also inversely proportional to the square of distance i.e, $F = G\frac{m_1m_2}{r^2}$ $F \propto \frac{1}{r^2}$
iii. Electric force is a strong force.	iii. Gravitational force is a weak force.
iv. Electric force is attractive or repulsive force.	iv. Gravitational force only a attractive force.
v. Electric force depends upon the medium.	v. It does not depend upon the medium.

73. Define surface charge density. Also give its SI unit.

Ans: Surface charge density is a measure of how much electric charge is ccumulated over a surface. It is calculated as the charge per unit surface area. If σ is the charge and A is the area of the surface. then the surface charge density is given by; σ =q/A, The SI unit of surface charge density is Cm^{-2}.

74. A particle carrying a charge of 5e falls through a potential difference of 2 V. Calculate the energy acquired by it.

Ans: It is given that $q = 5e$

$$\Delta V = 2\,V$$

The energy acquired by the particle is

$$\Delta(K.E.) = q\Delta V$$
$$\Delta(K.E.) = (5e)(2V)$$
$$\Delta(K.E.) = 10\,eV$$
$$\Delta(K.E.) = 10 \times 1.6 \times 10^{-19}\,J$$
$$\Delta(K.E.) = 16 \times 10^{-19}\,J$$

75. Define volt and electron volt.

Ans: Volt: A potential difference of 1 volt exists between two points if work done in moving a unit positive charge from one point to other keeping equilibrium is 1 joule.

$$1\,volt = 1\frac{Joule}{1\,Coulomb}$$

Electron volt: The amount of energy acquired or lost by an electron when it is displaced across two points having a potential difference of one volt. It is measured in *electron volts (eV)*.

76. How much energy will store in a capacitor of capacitance 1 μF having electrical potential of 10V between the parallel plate's capacitor.

Ans:

It is given that $C = 1\,\mu F = 1 \times 10^{-6} F$

$V = 10\,V$

Energy = E =?

Energy stored in a capacitor is given as,

$$E = \frac{1}{2}CV^2$$

Putting the values we get,

$$E = \frac{1}{2} \times 1 \times 10^{-6} \times (10)^2$$
$$E = \frac{1}{2} \times 1 \times 10^{-6} \times 100 = 0.5 \times 10^{-4}\,J$$

77. Define electron volt. Is it a unit of electrical potential or energy?

The amount of energy acquired or lost by an electron when it is displaced across two points having a potential difference of one volt. It is unit of energy in atomic physics.

LONG QUESTIONS OF CHAPTER-12 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Coulumb's Law:

1. State Coulomb's law for electrostatic force. Discuss its vector from and show that $\overrightarrow{F_{12}} = -\overrightarrow{F_{21}}$. (3 times)
2. Compare the properties of electric and gravitational force.

Topic IV: Applications of Electrostatics:

3. Define electrostatics and explain how is it applied in Xerography?

Topic V: Electric Flux:

4. Calculate the electric flux through a closed surface enclosing a charge 'q' in it.
5. Define electric flux. Show that electric flux due to point charge 'q' placed at the center of a sphere is equal to $\frac{q}{\varepsilon_0}$. (2 times)

6. Define electric flux. Find electric flux through a surface enclosing charge. (times)
   What is electric flux? Explain

Topic VIII: Gauss's Law:

7. State Gauss's Law and find electric intensity between two oppositely charged parallel plates. (3 Times)
8. State Gauss's law. Derive relation for electric intensity at a point near an in infinite sheet of charge. (6 times)

Topic IX: Electric Potential:

9. Define electric potential. Calculate the electric potential at the point due to a point charge. (5 times)
10. Define electric potential. Derive on equation for electric potential at a point due to a point charge.
11. What is electric potential? Find the electric potential at a point due to a point charge.

Topic XII: Charge on an Electron by Millikan's Method:

12. Describe Millikan's Oil drop method for determination of charge on an electron. (4 times)

Topic XIV: Capacitance of parallel plate Capacitor:

13. Define capacitance. Derive the expression for capacitance of a parallel plate capacitor. (2 times)
14. What is capacitor? Find the capacitance of parallel plate capacitor.
15. Define capacitor and capacitance. Find an expression for the capacitance of a parallel plate capacitor when a dielectric material is inserted between the plates. (5 times)
16. Derive the relation for capacitance of a parallel plate capacitor and hence define Dielectric Constant. (2 times)
17. Define capacitor and capacitance. Derive the formula for energy stored in a capacitor.
18. Define capacitor and capacitance. Find an expression for the capacitance of a parallel plate capacitor when vacuum is present between the plates of capacitor.

Topic XVI: Energy store in a capacitor:

19. What is the capacitor? Show that energy density for a capacitor which has electric field strength E is given by $\frac{1}{2}\varepsilon_r\varepsilon_0E^2$. (3 times)
20. Define capacitor and capacitance. Derive the formula for energy stored in a capacitor. (6 times)

Numerical Problems OF CHAPTER-12 IN ALL PUNJAB BOARDS 2011-2021

Topic II: Fields of Force:

1. **A point charge $q = -8 \times 10^{-8}\,C$ is placed at the origin. Calculate the electric field at a point 2.0 from origin on the z-axis.** (2 times)

Ans: Given that $q = -8 \times 10^{-8}\,C$

$$r = 2\,m$$

$$E = ?$$

Since $E = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$

$$E = -\frac{9 \times 10^9 \times 8 \times 10^{-8}}{(2)^2}$$

$$E = -1.8 \times 10^2\ NC^{-1}$$

Along $z - axis$ $\vec{E} = E\hat{k}$ $\boxed{= (-1.8 \times 10^2\hat{k})NC^{-1}}$

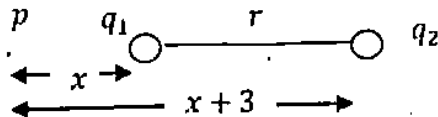
2. Two points charges $q_1 = -1.0 \times 10^{-6}C$ and $q_2 = 4.0 \times 10^{-6}C$ are separated by a distance of $3.0\ m$. Find and justify the zero field location. **(2 times)**

Ans: Given that

$$q_1 = -1.0 \times 10^{-6}C$$
$$q_2 = 4.0 \times 10^{-6}C$$
$$r = 3\ m$$

Zero field location = ?

Let p be a point at which electric field is zero as shown in figure

p — q_1 —— r —— q_2 ; ← x → ; ← x + 3 →

As E_1 balance E_2 at point p, therefore

$$E_1 = E_2$$
$$\frac{1}{4\pi\varepsilon_0}\frac{q_1}{x^2} = \frac{1}{4\pi\varepsilon_0}\frac{q_2}{(x+3)^2}$$
$$\frac{q_1}{x^2} = \frac{q_2}{(x+3)^2}$$
$$\frac{1\times10^{-6}}{x^2} = \frac{4\times10^{-6}}{(x+3)^2}$$
$$\frac{1}{x^2} = \frac{4}{(x+3)^2}$$
$$(x+3)^2 = 4x^2$$
$$x^2 + 6x + 9 = 4x^2$$
$$3x^2 - 6x - 9 = 0$$
$$x^2 - 2x - 3 = 0$$
$$x^2 - 3x + x - 3 = 0$$
$$x(x-3) + 1(x-3) = 0$$
$$(x-3)(x+1) = 0$$
$$x = 3\ m \quad ; \quad x = -1\ m$$

Since distance can never be negative, hence

$$\boxed{x = 3\ m}$$

3. **Determine the Electric Field at the position $\vec{r} = (4\hat{i} + 3\hat{i})m$ caused by a point charge q=5.0 x 10^{-4}C placed at origin.** **(6 times)**

Sol:

$$\vec{r} = (4\hat{i} + 3\hat{j})m$$
$$q = 5.0\times10^{-6}C$$
$$\frac{1}{4\pi\epsilon_0} = 9\times10^9\ Nm^2/C^2$$
$$\vec{E} = ?$$
$$|\vec{r}| = \sqrt{(4)^2 + (3)^2}$$
$$r = \sqrt{16+9} = \sqrt{25}$$
$$r = 5m \quad \text{______ (i)}$$

As $$\hat{r} = \frac{\vec{r}}{r}$$

$$\hat{r} = \frac{4\hat{i}+3\hat{j}}{5} \rightarrow (ii)$$

$$\vec{E} = E\hat{r}$$

$$\vec{E} = \frac{1}{4\pi\epsilon_0}\times\frac{q}{r^2}\hat{r}$$

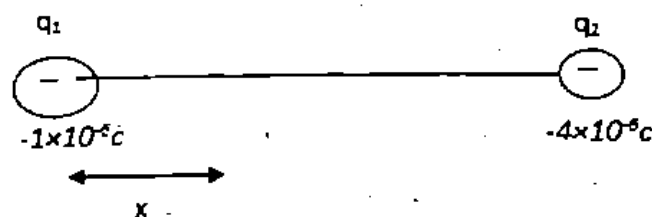
$$E = 9\times10^9\times\frac{5.0\times10^{-6}}{(5)^2}\times\left(\frac{4\hat{i}+3\hat{j}}{5}\right)$$

$$\vec{E} = \frac{45\times10^3}{25}\times\left(\frac{4\hat{i}+3\hat{j}}{5}\right)$$

$$\vec{E} = 360\left(4\hat{i}+3\hat{j}\right)$$

$$\vec{E} = 1440\hat{i}+1080\hat{j}$$

4. Two point charges, $q_1 = -1.0 \times 10^{-6}$ C and $q_2 = -4.0 \times 10^{-6}$ C are separated by a distance of 3.0 m. Find and justify the zero field location.

Sol:

$q_1 = -1.0\times10^{-6}$c
$q_2 = -4.0\times10^{-6}$c
$r = 3$m

Zero field location = ?

Let p be a point at which both the electric fields cancel out each other as shown in fig. this means that at point p,

$$E_1 = E_2$$

Or
$$\frac{1}{4\pi\epsilon_0}\frac{q_1}{x^2} = \frac{1}{4\pi\epsilon_0}\frac{q_2}{(r-x)^2}$$

Or
$$\frac{q_1}{x^2} = \frac{q_2}{(r-x)^2}$$

$$\frac{1.0\times10^{-6}}{x^2} = \frac{4.0\times10^{-6}}{(3-x)^2}$$

$$\frac{1}{x^2} = \frac{4}{(3-x)^2}$$

$$(3-x)^2 = 4x^2$$

Taking square root on both sides

$$3-x = +2x \qquad\qquad 3-x=-2x$$

$$3x = 3 \qquad\qquad x=-3m$$

$$x = 1m$$

As the distance can never be negative therefore, x = 1m from q_1 and r − x = 3 − 1 = 2m

Topic IX: Electric Potential:

5. In Bohr's atomic model of hydrogen atom, the electron is in an orbit around the nuclear proton at a distance of 5.29×10^{-11} m with a speed of $2.18 \times 10^6 ms^{-1}$. Find Electric potential that a proton exerts at this distance and the ionization energy for the atom in eV

Ans: Given that
$$r = 5.29 \times 10^{-11}\, m$$
$$v = 2.18 \times 10^{6} ms^{-1}$$
$$q = e = 1.6 \times 10^{-19}\, C$$
$$m = 9.1 \times 10^{-31} kg$$

I. Electric potential that a proton exerts at this distance

Since
$$V = \frac{1}{4\pi\varepsilon_0}\frac{q}{r}$$
$$V = \frac{9 \times 10^{9} \times 1.6 \times 10^{-19}}{5.29 \times 10^{-11}}$$
$$\boxed{V = 27.20\ volts}$$

II. The ionization energy for the atom in eV

As electron possess $-13.6\ eV$ energy in the ground state of hydrogen atom

So
$$E_{ion} = E_{\infty} - E_{ground}$$
$$= 0 - (-13.6\ eV) = 13.6\ e\,V$$

6. Two opposite point's charges each of magnitude q are separated by a distance $2d$. What is the electric potential at a point P midway between them? (3 times)

Ans: According to the given conditions
$$V_+ = \frac{1}{4\pi\varepsilon_0}\frac{q}{d}$$
And
$$V_- = -\frac{1}{4\pi\varepsilon_0}\frac{q}{d}$$
Thus
$$V = V_+ + V_-$$
$$V = \frac{1}{4\pi\varepsilon_0}\frac{q}{d} - \frac{1}{4\pi\varepsilon_0}\frac{q}{d}$$
$$\boxed{V = 0}$$

So potential at P due to opposite charges is zero.

7. Using zero reference point at infinity, determine the amount by which a point charge of $4.0 \times 10^{-8}C$ alters the electric potential at a point $1.2\ m$ away, when (a) charge is positive (b) charge is negative.

Ans: It is given that
$$q = 4.0 \times 10^{-8}C$$
$$r = 1.2\ m$$

(a) charge is positive

Since
$$V_+ = \frac{1}{4\pi\varepsilon_0}\frac{+q}{r}$$
$$V_+ = \frac{9 \times 10^{9} \times 4.0 \times 10^{-8}}{1.2}$$
$$\boxed{V_+ = +300\ volts}$$

(b) charge is negative

Since
$$V_- = \frac{1}{4\pi\varepsilon_0}\frac{-q}{r}$$
$$V_- = -\frac{9 \times 10^{9} \times 4.0 \times 10^{-8}}{1.2}$$
$$\boxed{V_- = -300\ volts}$$

8. A particle having a charge of 20 electrons on it falls through a potential difference of 100 $volt$. Calculate the energy by it in electron volts. (7 times)

Ans: It is given that
$$n = 20\ eletrons$$
$$e = 1.6 \times 10^{-19}\ C$$

$$q = ne = 20 \times 1.6 \times 10^{-19}$$
$$\Delta V = 100\ V$$
$$\Delta(K.E.) = ?$$

Since
$$\Delta(K.E.) = q\Delta V$$
$$\Delta(K.E.) = (20 \times 1.6 \times 10^{-19})(100)$$

In electron volts
$$\Delta(K.E.) = \frac{(20\times1.6\times10^{-19})(100)}{1.6\times10^{-19}}$$
$$\Delta(K.E.) = 2000\ eV \boxed{= 2.0 \times 10^{3}\ eV}$$

9. A particle carrying a charge of $2e$ falls through a P.D. of $3.0\ V$. Calculate the energy acquired by it. (3 Times)

Ans: It is given that
$$q = 2e$$
$$\Delta V = 3.0\ V$$

The energy acquired by the particle is
$$\Delta(K.E.) = q\Delta V$$
$$\Delta(K.E.) = (2e)(3V)$$
$$\Delta(K.E.) = 6\ eV$$
$$\Delta(K.E.) = 6 \times 1.6 \times 10^{-19}\ J \boxed{= 9.6 \times 10^{-19}\ J}$$

Topic XII: Charge on an Electron by Millikan's Method:

10. Find the electric field strength required to hold a suspended particle of mass 1.0 x 10^{6} kg and charge 1.0, u C between two plates 10.0 cm apart. (2 times)

Ans: It is given that $q = 1uC = 1.0 \times 10^{-6}C$
$$m = 1.6 \times 10^{-6}\ kg$$
$$d = 10\ cm = 0.1\ m$$
Electric field strength = E =?

The particle will be suspended between the plates when,

Electric force = weight
$$F_e = F_g$$
$$qE = mg$$
$$E = \frac{mg}{q}$$

Putting the values, $E = \frac{1\times10^{-6}\times9.8}{1\times10^{-6}}$
$$\boxed{E = 9.8\ NC^{-1} \text{ or } Vm^{-1}}$$

Topic XIII: Capacitor:

11. A capacitor has a capacitance of $2.5 \times 10^{-8}F$. In charging process, electrons are removed from one plate and placed on the other one. When a potential difference between the plates is $450\ V$, how many electrons have been transferred?

Ans:

Given that
$$C = 2.5 \times 10^{-8}F$$
$$V = 450\ V$$
$$e = 1.6 \times 10^{-19}C$$

$$n = ?$$

Since $Q = ne$

$$number\ of\ electron = n = \frac{Q}{e}$$

But $Q = CV$

So $\frac{CV}{e}$

$$n = \frac{2.5 \times 10^{-8} \times 450}{1.6 \times 10^{-19}}$$

$$\boxed{n = 7.03 \times 10^{13}\ electrons}$$

Topic XVI: Energy store in a capacitor:

12. The electronic flash attachment for a camera contains a capacitor for storing the energy used to produce the flash. In one such unit, potential difference between the plates of a 750 uF capacitor is 330V. Determine the energy which is used to produce the flash.

Ans: It is given that $C = 750\ uF = 750 \times 10^{-6} F$

$V = 330\ V$

Energy = E = ?

Energy stored in a capacitor is given as,

$$E = \frac{1}{2} CV^2$$

Putting the values we get,

$$E = \frac{1}{2} \times 750 \times 10^{-6} \times (330)^2$$

$$E = \frac{1}{2} \times 750 \times 10^{-6} \times 330 \times 330 \boxed{= 40.8\ J}$$

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13. Compare magnitudes of electrical and gravitational forces exerted on an object (mass 10.0 g, charge = 20.0 μC) by an identical object that is placed 10.0 cm from the first. ($G = 6.67 \times 10^{-11}\ Nm^2kg^{-2}$)

Data:

Mass of one object $= m_1 = 10.0\,g = \frac{10.0}{1000} kg = 0.01\,kg$

Mass of 2nd object $= m_2 = 10.0\,g = \frac{10.0}{1000} kg = 0.01\,kg$

Charge on one object = $q_1 = 20.0\,\mu C$

$= 20 \times 10^{-6} C$

Charge on 2nd object = $q_2 = 20 \times 10^{-6} C$

Distance between the charges $= 10.0\,cm = 0.1\,m$

Comparison of forces $= \frac{F_e}{F_g} = ?$

Solution:

For electrical force

$$F_e = k\frac{q_1 q_2}{r^2}$$

But $k = 9 \times 10^9\ N.m^2/C^2$

$$F_e = \frac{9\times10^9\times20.0\times10^{-6}\times20.0\times10^{-6}}{(0.1)^2}$$

$$= \frac{3600\times10^{9-6-6}}{0.01}$$

$$= \frac{3600}{0.01}\times10^{-3}$$

$$F_e = 360000\times10^{-3}$$

$$= 360\,N$$

For gravitational force

$$F_g = \frac{Gm_1m_2}{r^2}$$

But $G = 6.673\times10^{-11}\,N.m^2/Kg^2$

So, $$F_g = \frac{63673\times10^{-11}\times0.01\times0.01}{(0.1)^2}$$

$$F_g = \frac{63673\times10^{-11}\times(0.01)^2}{(0.01)}$$

$$F_g = 6.673\times10^{-13}\,N$$

Therefore, $$\frac{F_e}{F_g} = \frac{360}{6.673\times10^{-13}}$$

$$= 53.9\times10^{13}$$

$$= 5.4\times10^{14}$$

14. The time constant of a series RC circuit is t = RC. Verify that an ohm times farad is equivalent to second.

Solution: Ohm's law in terms of potential difference V, current I and resistance R can be written as

$$V = IR$$

Putting $I = \frac{q}{t}$

$$V = \frac{q}{t}R$$

Or $$R = \frac{V\times t}{q}$$

According to equation

$$q = CV, C = \frac{q}{V}$$

Multiplying this equation with above equation gives

$$RC = \frac{V\times t}{q}\times\frac{q}{V} = t$$

Hence 1 ohm × 1 farad = 1 second

OBJECTIVES (MCQ'S) OF CHAPTER-13 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Electric Current:

1. Drift velocity of electrons in a conductor is: **(3 times)**
(A) $10^{2} m s^{-1}$ (B) $10^{-3} m s^{-1}$ (C) $10^{3} m s^{-1}$ (D) $10^{2} m s^{-1}$

2. Charge carriers in electrolytes are:
(A) Protons (B) Electrons (C) Holes (D) Positive and negative ions

3. Thermo couple coverts to electrical energy from:
(A) Solar energy (B) Heat energy (C) Chemical energy (D)Mechanical energy

4. The velocity of an oscillating charge as it moves to and fro along the wire is: **(2 Times)**
(a) Changing (b) Constant (c) Infinite (d) Zero

5. A battery move a charge of 40C around a circuit at constant rate in 20sec. The current will be:
(a) 2 A (b) 0.5 A (c) 80 A (d) 800 A

6. The thermistor converts changes of temperature into:
(a) Light energy (b) electric voltage (c) heat (d) sound

7. A current flowing toward the reader is denoted by:
(a) Cross (b) a bracket (c) a dot (d) positive sign

8. Thermo-converts heat energy into
(A) Atomic energy (B) Solar energy (C) Electrical energy (D) Nuclear energy

9. The current which flows from a point at higher potential to a point at lower potential is called.
(A) Electric current (B) Conventional Current (C) either of these (D) None of above

Topic II: Ohm's Law:

10. The example of non ohmic devices are:
(A) Inductor (B) Capacitor (C) Semi-conductor diode (D) Resistor

11. Sec/ohm is equal to: **(2 Times)**
(A) Farad (B) Coulomb (C) Joule (D) Ampere

12. 1 Ohm is defined as: **(2 Times)**
(A) $1\,VC^{-1}$ (B) $1\,VA^{-1}$ (C) $1\,CV^{-1}$ (D) $1\,VA$

13. A source of 10 volts is applied across a 5Ω wire, the current is:
(A) 1A (B) 2A (C) 10A (D) 15V

14. Graphical representation of Ohm's law is:
(A) Circular (B) Ellipse (C) Parabola (D) Straight line

15. Slope of V – I graph in Ohm's law is numerically equal to:
(A) Resistance (B) Power (C) Conductance (D) Capacitance

Topic III: Resistivity and its dependence upon temperature:

16. $mho\ m^{-1}$ is the SI unit of: **(3 times)**
(A) Conductivity (B) Conductance (C) Resistance (D) Capacitance

17. Reciprocal of resistance is called: **(4 times)**
(A) Conductance (B) Resistor (C) Conductivity (D) Resistivity

18. Material having positive temperature co-efficient is:
(A) Carbon (B) Copper (C) Silicone (D) Germanium

19. A battery of 50 volts is attached to a series combination of $5\Omega, 0\Omega$ and 10Ω. The current in the circuit is:
(A) 2 amp (B) 3.34 amp (C) 10 amp (D) 20 amp

20. Conductors have conductivities of the order of:
(A) $10^{3}(\Omega m)^{-1}$ (B) $10^{7}(\Omega m)^{-1}$ (C) $10^{-7}(\Omega m)^{-1}$ (D) $10^{-6}\Omega$

21. A wire of uniform area of cross section 'A' and length 'L' is cut into two equal parts. The resistivity of each part is: **(2 times)**
(A) Doubled (B) Half (C) Remains the same (D) Increases three times

22. The smallest resistance obtained by connecting 50 resistances each of $\frac{1}{4}\Omega$ is
(A) 200 Ω (B) $\frac{1}{200}\Omega$ (C) $\frac{50}{4}\Omega$ (D) $\frac{4}{50}\Omega$

23. Equivalent resistance when two resistances are connected in parallel is given by:
(A) $\frac{R_1+R_2}{R_1R_2}$ (B) $R_1 + R_2$ (C) $\frac{R_1R_2}{R_1+R_2}$ (D) $\frac{R_1R_2}{R_1-R_2}$

24. Temperature co-efficient of resistivity is measured in: **(3 Times)**
(A) Ωk (B) Ωm (C) K^{-1} (D) K

25. A certain wire has a resistance R, the resistivity of another wire of an identical material with the first, except for twice its diameter is:
(A) $\frac{1}{4}$R (B) 4R (C) 2R (D) Same as R

26. Temperature coefficient of resistance (α) is equal to:
(A) $\frac{R_t+R_0}{R_0\Delta t}$ (B) $\frac{R_0-R_t}{R_0\Delta t}$ (C) $\frac{R_t-R_0}{R_0\Delta t}$ (D) None of these

27. The SI unit of resistivity is:
(A) Ohm-m^{-1} (B) Ohm-m^0 (C) Ohm-m^1 (D) Ohm-m^2

28. Three 1 ohm resistors are connected to form a triangle, the resistance between any two corners is:-
(a) $\frac{2}{3}\Omega$ (b) $\frac{3}{2}\Omega$ (c) $\frac{1}{2}\Omega$ (d) 3 Ω

29. Specific resistance of a material depends upon:
(a) Length (b) Area (c) Temperature (d) Both A & B

30. A substance having the negative temperature coefficient of resistivity out of the following is: **(2 times)**
(A) Iron (B) Tungsten (C) Carbon (D) Gold

31. Heat generated by a 40 watt bulb in one hour is:
(A) 4800J (B) 14400 J (C) 44000 J (D) 1440 J

32. With the rise in temperature, the conductivity of semi-conductor material:
(A) Increase linearly (B) Decreases Linearly
(C) Increases exponentially (D) Decreases exponentially

33. By increasing the temperature of conductor, the flow rate of charges)
(A) Increases (B) Remains constant (C) Changes exponentially (D) Decrease

Topic IV: Colour Code for Carbon Resistances:

34. The color code for carbon resistance usually consists of:
(A) 3 bands (B) 4 bands (C) 2 bands (D) 7 bands

35. If fourth band on a carbon resistor is of silver colour then its tolerance is: **(2 Times)**
(A) ±1% (B) ±5% (C) ±10% (D) ±20%

36. The numerical value of violet colour in colour code resistors is:
(A) 0 (B) 06 (C) 05 (D) 07

37. The numerical value of green colour in colour code carbon resistor is:
(A) 0 (B) 3 (C) 5 (D) 8

38. The color of strips on a carbon resistor from extreme left is yellow, black and red respectively. Its resistance is:
(A) 4 $k\Omega$ (B) 400 Ω (C) 40 Ω (D) 40 $k\Omega$

39. In colour code of resistance orange colour represents:
(A) 0 (B) 1 (C) 2 (D) 3

40. Which of the following is not accurate measuring device?
(A) Digital multimeter (B) CRO (C) Potentiometer (D) Voltmeter

41. IF fourth band is missing on resistance, its tolerance is: **(2 Times)**
(A) ± 5 % (B) ± 10 % (C) ± 15 % (D) ± 20 %

42. Colour code of yellow colour is:
(A) 2 (B) 3 (C) 4 (D) 5

43. Resistance tolerance for gold colour is:-
(a) 50% (b) 30 % (c) 20 % (d) 5 %

44. Kirchhoff's voltage rule is a way of stating conservation of:
(A) Energy (B) Momentum (C) Charge (D) Angular
45. The numerical value of balck colour in carbon resistors is:
(A) 0 (B) 1 (C) 2 (D) 3

Topic V: Rheostate:

46. A rheostat can be used as: (2 times)
(A) Potential divider (B) Rectifier (C) Amplifier (D) Oscillator

Topic VI: Electric Power and Power dissipation in Resistor:

47. Power output is given by:
(A) $\frac{E^2R}{(R+r)^2}$ (B) $\frac{E^2R}{(R+r)+4Rr}$ (C) I^2R (D) All of these
48. If a resistor of resistance R is connected across a battery of internal resistance 'r' then output power will be maximum when: (2 times)
(A) R = ¼ r (B) R = r (C) R = 2r (D) R = 4r

Topic VII: Electromotive force and Potential Difference:

49. If a resistor is transversed in the opposite direction of current then the change in potential is:
(A) Zero (B) Negative (C) Positive (D) Constant
50. Terminal potential difference of a battery of internal resistance 'r' & emf ε is:
(A) $V = \varepsilon + Ir$ (B) $V = \varepsilon - Ir$ (C) $V = \frac{\varepsilon - r}{I}$ (D) $V = \frac{I}{\varepsilon - r}$
51. The relation of emf of two cells $\frac{E_1}{E_2}$ is =:
(A) $\frac{l_2}{l_1}$ (B) $\frac{l_1}{l_2}$ (C) $\frac{1}{l_1 l_2}$ (D) $l_1 \times l_2$
52. The potential difference between the head and tail of an electric eel is:
(a) 600 volts (b) 700 volts (c) 800 volts (d) 900 volts
53. The product of charge and potential difference is:
(A) Flux (B) Current (C) Energy (D) Power

Topic VIII: Kirchhoff's Rules:

54. Kirchhoff's first rule is based on conservation of: (2 times)
(A) Energy (B) Voltage (C) Charge (D) Mass

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55. What is the resistance of a carbon resistor which has bands brown, black and brown?
(a) 100 Ohm (b) 1000 Ohm (c) 10 Ohm (d) 1.0 Ohm
56. The current flowing through each resistor of equal resistance in parallel combination is:
(a) Same (b) Different (c) zero (d) infinite
57. The maximum power is delivered to a load resistance 'R' when the internal resistance of the source is:
(a) Zero (b) Infinite (c) Equal to 'R' (d) Equal to $\frac{R}{2}$
58. Three resistances each of 4Ω are connected to form a triangle, the resistance between any two terminals is:
(A) 4 Ω (B) 12 Ω (C) 8/3 Ω (D) 3/8 Ω
59. Kirchhoff's second rule is based on: (2 Times)
(A) Energy conservation (B) Mass conservation
(C) Charge conservation (D) Momentum conservation
60. An ideal current source shall have resistance:
(A) zero (B) finite but not zero
(C) infinite (D) depends upon requirement
61. The current through a resistance of 100Ω when connected across a source of 220V is:
(A) 22000 A (B) 22A (C) 2.2A (D) 0.45A
62. What is the colour code for 52MΩ±5% resistance:
(A) Red Green Blue Gold (B) Green Red Blue Gold

(C) Yellow Red Blue Gold (D) Green Red Violet Gold

63. The potential difference between the head and tail of an electric field can be up to:
(A) 500 V (B) 600 V (C) 700 V (D) 800 V

64. Magnetic effect of current is used in:
(A) toaster (B) Electric motor (C) electric iron (D) D.C battery

65. 5 A of current flows through a conductor in 2 minutes, charge in the wire is:
(A) 500 C (B) 600 C (C) 400 C (D) 10 C

66. The resistance of a conductor of length L, cross-sectional area 'A' and resistivity 'ρ' is given by:
(A) $R=\frac{\rho}{AL}$ (B) $R=\rho AL$ (C) $R=\rho\frac{L}{A}$ (D) $R=\rho\frac{A}{L}$

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67. A resistor of resistance 'R' is cut into two equal parts of resistance R/2, its resistivity becomes:
(A) half (B) remains same (C) double (D) four times

68. Siemen is the unit of:
(A) Resistivity (B) Resistance (C) Conductivity (D) Conductance

69. Dielectric coefficient is represented by:
(A) ε_o (B) ε_r (C) μ_o (D) μ_r

70. Three Resistances 1 Ω, 2 Ω and 3 Ω are connected in series to a battery of 9 volts. The current flowing through each resistance will be:
(A) 1.5 A (B) 1.0 A (C) 0.5 A (D) 2.0 A

71. Kirchhoff's 2nd rule is a manifestation of law of conservation of: (3 times)
(A) Energy (B) Charge (C) Mass (D) Momentum

72. Heat generated by a 50 watt bulb in one hour is: (2 times)
(A) 36000 J (B) 48000 J (C) 18000 J (D) 180000 J

73. Kirchhoff's First Rule is a manifestation of Law of conservation of:
(A) Mass (B) Energy (C) Charge (D) Momentum

74. When a wire of resistance R is cut into two equal parts then resistance of each wire is:
(A) Doubel (B) Half (C) Remain same (D) One forth

75. In carbon resistors, which colour band indicates the tolerance of ±10%?
(A) White (B) Silver (C) Gold (D) Violet

76. For an open circuit, terminal potential difference 'V_t' is:
(A) V_t=2emf (B) V_t=emf (C) V_t>emf (D) V_t<emf

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77. Colour code of 10Ω resistance with 5% tolerance is:
(A) Black, black, Brown, Silver (B) Brown, black, black, Gold
(C) Black, brown, black, Gold (D) Brown , brown, black, Gold

78. The SI unit of conductance is
(A) Siemen (B) Ohm (C) Henry (D) Weber

79. SI unit of conductivity is:
(A) $mho\ m^{-1}$ (B) Siemen (C) $\Omega\ m$ (D) $\Omega\ K^{-1}$

80. A thermistor is a heat sensitive:
(A) Resistor (B) Capacitor (C) Inductor (D) Diode

81. On increasing the length of wire specific resistance of the wire:
(A) Increases (B) Decreases
(C) Remains unchanged (D) First increase then decrease

82. Which one of the following is used to determine internal resistance of a cell:
(A) Potentiometer (B) Wheat Stone Bridge
(C) Ammeter (D) Voltmeter

83. If the length of the conductor is doubled and its cross sectional area is halved, its conductance will :
(A) Increases four times (B) Becomes one-fourth
(C) Becomes one-half (D) Remains unchanged

ANSWERS OF THE MULTIPLE CHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10	11
B	D	B	A	A	B	C	C	B	C	A
12	13	14	15	16	17	18	19	20	21	22
B	B	D	C	A	A	B	B	B	C	B
23	24	25	26	27	28	29	30	31	32	33
C	C	D	C	C	A	C	C	B	A	D
34	35	36	37	38	39	40	41	42	43	44
B	C	D	C	A	D	D	D	C	D	A
45	46	47	48	49	50	51	52	53	54	55
A	A	A	B	C	B	B	A	C	C	A
56	57	58	59	60	61	62	63	64	65	66
A	C	A	A	C	C	B	B	B	B	C
67	68	69	70	71	72	73	74	75	76	77
B	D	B	A	A	D	C	B	B	B	B
78	79	80	81	82	83					
A	A	A	C	A	B					

SHORT QUESTIONS OF CHAPTER-13 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Electric Current:

1. How the heating effects produce when current flows through the conductor?

Ans: During their motion free electrons collide frequently with the atoms of metal, on each collision they transfer some of their kinetic energy to the atom with which they collide. And these collisions produce heating effect in the wire.

$$H = I^2Rt$$

2. What is the conventional current? How does it differ from electric current?

Ans: The current flow due to positive charges from a point at higher potential to a point at lower potential is called conventional current.
It is due to positive charges while electric current is due to negative charges i.e. electrons.

3. Do two long and parallel current carrying wires attract each other? Explain.

Ans: Yes, if the direction of current is same in two long parallel current carrying wires. Because the opposite pole of electromagnets come in front of each other and attracts.

4. Name any four sources of current. (2 times)

Ans: Sources of current are

i. Cells ii. Electric generators
iii. Thermocouples iv. Solar cells

5. What does the equation $H = I^2Rt$ show? (2 times)

Ans: This equation shows the heating effect. During their motion free electrons collide frequently with the atoms of metal, on each collision they transfer some of their kinetic energy to the atom with which they collide. And these collisions produce heating effect in the wire.

6. Differentiate between conventional and non-conventional current.

Ans: Conventional current: The current flow due to positive charges from a point at higher potential to a point at lower potential is called conventional current.
Non-conventional current: The amount of electric charge that flows through a cross section of a conductor per unit time is known as electric current. It is also known as non-conventional current.

7. Name some effects of current. (2 times)

Ans: Some effects are

i. Heating effect ii. Magnetic effect iii. Chemical effect

8. Define conventional current and electronic current.

Ans: <u>Conventional current:</u> The current produced due to the motion of positive charge carriers is called conventional current. It flows from high potential towards the low potential.

<u>Electronic current:</u> The current due to the flow of Negative charge particles i.e (Electron) is known as electronic current.

9. Write about any two sources of Current. (3 times)

Ans: (i) Electric generators convert mechanical energy into electrical energy.

(ii) Solar cells convert sunlight directly into electrical energy.

(iii) Thermo-couples convert heat energy into electrical energy.

10. Define conventional current and solar cell.

Ans: The current flow due to positive charges from a point at higher potential to a point at lower potential is called **conventional current.**

Solar cell is a source of current which converts sunlight directly into electrical energy.

11. Define sources of current and give its two examples.

Ans: A source of current maintains a constant potential difference between ends of a conductor. Every source of current converts some non-electrical energy into electrical energy.

For Example:

(i) Solar cells convert sunlight directly into electrical energy.

(ii) Cells or batteries convert chemical energy into electrical energy.

Topic II: Ohm's Law:

12. What are the difficulties in testing weather the filament of lighted bulb obeys ohm's law? (9 times)

Ans: In case of a lighted bulb, the temperature of the filament increases with the passage of current through it. Hence the Ohm's law can't be applied to filament bulb.

13. What are non-ohmic devices? Give two examples. OR What are non-ohmic substance. Give two examples.

Ans: Those devices which don't obey the Ohm's law are called non-ohmic devices. Their current-voltage graphic is not a straight line.

For example, filament bulb and semi-conductor diodes.

14. State Ohm's law and define resistance. (2 times)

OR State Ohm's law and write its formula.

Ans: <u>Ohm's law:</u>It states that "the current flowing through a conductor is directly proportional to the applied potential difference provided that the physical state remains same."

$$V \propto I$$

$$V = IR$$

<u>Resistance:</u> The opposition against the flow of current is known as resistance. The SI unit of resistance is Ohm.

$$R = \frac{V}{I}$$

15. Differentiate between ohmic and non ohmic devices with examples. (2 times)

Ans: The devices which obey Ohm's law are called ohmic devices and devices which do not obey Ohm's law are called non-ohmic devices. For example copper, silver and gold are ohmic whereas diodes and tungsten filaments are non ohmic.

16. Define Ohm's law. Also define ohmic and non-ohmic devices. (2 times)

Ans: The current flowing through a conductor is directly proportional to potential difference across the ends provided the physical state of the conductor does not change. Mathematically, $V = IR$

The devices which obey Ohm's law are called ohmic devices and devices which do not obey Ohm's law are called non-ohmic devices.

17. **State Ohm's law and basic principle of electroplating.**

Ans: **Statement of Ohm's law:** Current passing through a wire is directly proportional to the potential difference applied across its ends provided that the physical state of conductor remains same.

Mathematically, $I \propto V$

Or V = IR

Basic principle of electroplating is "a process of coating a thin layer of sum expensive metal of (gold, silver etc) on an article of some cheap metal".

18. **Define electrolysis and basic principle of electroplating.**

Ans: Certain liquids conduct electricity due to some chemical reaction that takes place within them. The study of this process is known as **electrolysis.**

The **basic principle of electroplating** is "a process of coating a thin layer of some expensive metal (Gold, silver etc) on an article of some cheap metal.

Topic III: Resistivity and its dependence upon temperature:

19. **Why does the resistance of a conductor rise with a temperature?** **(17 times)**

Ans: As the temperature of the conductor rises, the amplitude of vibration of atoms increases and hence the probability of their collision with free electrons also increases which results in increase of resistance of conductor.

20. **Do bends in a wire effect its electrical resistance?** **(16 times)**

Ans: No, bends in a wire do not affect its electrical resistance.

Electrical resistance is given as

$$R = \rho\frac{L}{A}$$

It shows that resistance depends upon length of the wire L and area of cross-section A. Thus the bends in a wire do not affect its electrical resistance.

21. **Is the filament resistance lower or higher in a 500 watt, 220 volt light bulb than in a 100 watt, 220 volt bulb?** **(15 times)**

Ans: Since

$$P = \frac{V^2}{R}$$

$$R = \frac{V^2}{P}$$

For $P = 500\ W$ and $V = 220\ V$, we get

$$R = \frac{(220)^2}{500}$$

$$R = 98.6\ \Omega$$

And

For $P = 100\ W$ and $V = 220\ V$, we get

$$R = \frac{(220)^2}{100}$$

$$R = 484\ \Omega$$

Thus

It is clear that the filament resistance is lowered in a $500\ W, 220\ V$ bulb than in a $100\ W, 220\ V$.

22. **Write down the value of equivalent resistance for three resistors R_1, R_2 and R_3 when joined in:** **(a) series** **(b) parallel**

Ans: In a series combination

$$R_{eq} = R_1 + R_2 + R_3$$

and

In a parallel combination

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

23. **What is the negative co-efficient of temperature?**

Ans: If the resistance of a substance decrease with an increase in temperature, then it is termed as negative coefficient of temperature.

For example, silicon and germanium have negative coefficient of temperature.

24. What is thermistor? Describe its two uses. **(6 Times)**
OR What is thermistor? Give its two applications.
OR What are thermistors? How they are used?

Ans: Thermistors are heat sensitive resistors. Thermistors with positive temperature coefficient of resistance as well as negative temperature coefficient of resistance are available.
They are used for accurate measuring of temperature up to $10\,K$. They are used as temperature sensors.

25. Differentiate between resistance and resistivity. Give their unit. (3 times)

Ans: **Resistance:** The opposition against the flow of current is known as resistance. The SI unit of resistance Is Ohm.

$$R = \frac{V}{I}$$

Resistivity: The resistance of a meter cube of a material Is called resistivity.

$$\rho = \frac{RA}{L}$$

Its unit is ohm-meter.

26. A wire of length 10m has resistance 100Ω. If the wire Is stretched to Increase its length three times. What will be its new resistance?

Ans: As we know that $R = \rho\frac{L}{A}$
It shows that the resistance R is directly related to the length L, so if a wire of 100Ω is stretched three times then its resistance will also increase three times. Thus new resistance in stretched wire of 30m will be 300Ω.

27. What is thermistor? Write its principle. **(2 times)**

Ans: It is a heat sensitive resistor which is made up of metal oxides semiconductor materials which operates when exposed to heat thus converting changes of temperature into electrical voltage which is duly processed.
The resistance of thermistor changes with the change in temperature is its working principle.

28. Define temperature coefficient of resistivity. **(2 times)**

Ans: The temperature coefficient of resistivity is defined as fractional change in resistivity per kelvin rise in temperature. Its unit is K^{-1}.

$$\alpha = \frac{\rho_t - \rho_o}{\rho_o\, t}$$

29. Define Resistance. Also define its unit.

Ans: **Resistance:** The opposition against the flow of current is known as resistance. The SI unit of resistance is Ohm.
Ohm: If a current of 1A flows through a conductor when a potential difference of 1V is applied across its ends then the resistance of conductor will be 1Ω (Ohm).

30. Define temperature coefficient of resistance. Give its unit. **OR**
What is temperature co-efficient of resistance? **OR**
Define temperature co-efficient of resistance and write its formula. (5 times)

Ans: The temperature coefficient of resistance is defined as fractional change in resistance per kelvin rise in temperature. Its unit is K^{-1}.
Mathematically,

$$\alpha = \frac{R_t - R_o}{R_o\, t}$$

31. Give two substances having negative temperature co-efficient. Also define temperature co-efficient.

Ans: The temperature coefficient of a resistance is defined as fractional change in resistance per kelvin rise in temperature. Its unit is K^{-1}.
Substances like Ge and Si have negative temperature coefficients.

32. Define resistivity and electrolysis.

Ans: The resistance of a meter cube of a material is called **resistivity.**
Certain liquids such as dilute sulphuric acid or copper sulphate solution conduct electricity due to some chemical reactions that take place within them. The study of this process is known as **electrolysis.**

33. Differentiate between resistivity and conductivity.

Ans: The resistance of a meter cube of a material is called resistivity. It is denoted by ρ. It is measured in Ωm.

Conductivity is the reciprocal of resistivity. It is denoted by σ.

$$\sigma = 1/\rho$$

It is measured in $\Omega^{-1}m^{-1}$.

Topic IV: Colour Code for Carbon Resistances:

34. Find the resistance and tolerance of a resistor having color bands starting with brown, green, red and finisher with gold

Ans: The color codes are as follows

Brown	1	1^{st} *digit*
Green	5	2^{nd} *digit*
Red	2	*number of zeros*

Therefore $Resistance = 1500\ \Omega$

and $Tolerance = \pm 5\ \%$

35. What is the resistance of colour code resister having colours yellow, white, orange and silver respectively? What is its tolerance?

Ans: The color codes are as follows

Yellow	4	1^{st} *digit*
White	9	2^{nd} *digit*
Orange	3	*Number of zeros*

Therefore $Resistance = 49000\ \Omega$

and $Tolerance = \pm 10\ \%$

36. Give the color code.

Ans: Color code is

Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Grey	8
White	9

37. What is meant by Tolerance'? Also give one example.

OR What is meant by tolerance of a resistor?

OR What do you meant by tolerance of a resistor? How is it expressed by different colours? (4 times)

Ans: Tolerance means the possible variation in the value of resistance of a carbon resistor from a marked value. In case of silver and gold band its value is ±10% and ±5%, respectively.

For example, for a silver band resistor of 1000 Ω, its actual value may be anyone between 900 Ω and 1100 Ω which means ±10% tolerance.

38. What is meant by tolerance? Find the resistance of a resistor with red, green, orange and gold respective bands.

Ans: Tolerance means the possible variation from the marked value.

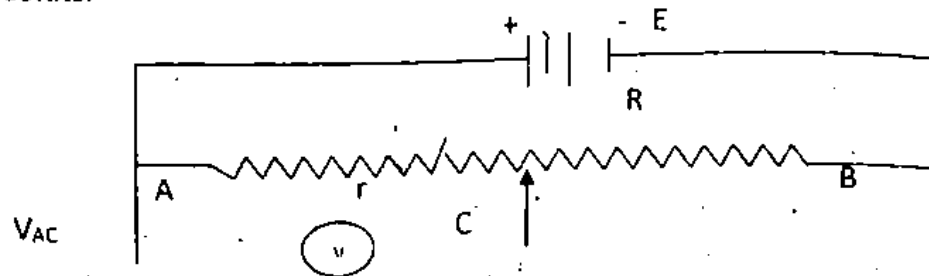
For silver band tolerance is ±10% and for gold band is ±5%.

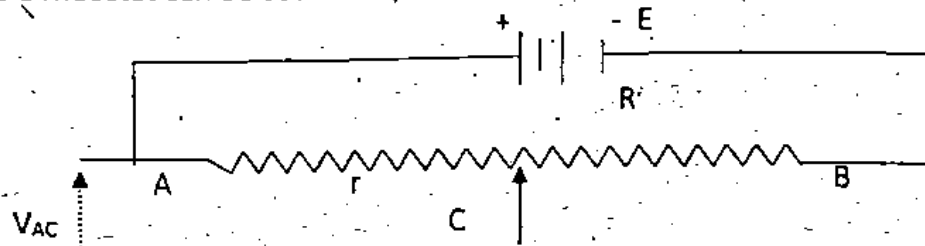
The resistance of given resistor is = (25000 ± 5%) Ω

Topic V: Rheostat:

39. Describe a circuit that will give continuously varying potential. (12 times)

Ans: A potential divider or potentiometer is a circuit that will give continuously varying potential. A potentiometer is a three-terminal resistor with a sliding

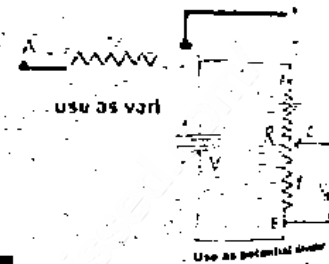
contact that forms an adjustable voltage divider. Potentiometers are made from Rheostats.

40. How can a rheostat be used as potential divider?

Ans: By adjusting the sliding contact resistance of the rheostat can be altered which in turn would regulate the potential offered by the cell E to the main circuit. And thus a rheostat can be used as a potential divider.

41. Write two uses of rheostat and draw their diagrams. **(2 times)**

OR What are the uses of rheostat?

Ans: (i) Rheostat can be used as a variable resistor.

(ii) Rheostat can be used as a potential divider circuit.

$$V_{BC} = \frac{r}{R}V$$

Topic VII: Electromotive force and Potential Difference:

42. What is effect on drift velocity of free electrons by increasing potential difference? **(2 times)**

Ans: By an increase in potential difference, drift velocity will also increase. Because by increasing potential difference, the current also increases i.e. $V \propto I$

43. A potential difference is applied across the ends of a copper wire. What is the effect on the drift velocity of the free electrons by increasing the potential difference? **(5 times)**

Ans: Drift velocity is $v_d = \frac{\Delta V}{nepL}$

Clearly $v_d \propto \Delta V$

Thus, drift velocity of electron increases with increase in potential difference.

44. Why the terminal potential difference of a battery decreases when the current drawn from it is increased? **(9 times)**

Ans: The terminal potential difference is $V_t = \varepsilon - Ir$

Clearly

When I is large, the factor Ir becomes large and V_t becomes small. Hence terminal potential difference of a battery decreases when current drawn from it is increased.

45. A voltmeter cannot read the exact EMF of the cell. Why? **(3 times)**

Ans: When a voltmeter is connected across a cell, it will draw some current from the cell and a small potential droptakes place due to the current flowing through the internal resistance of the cell. As a result, the actual emf of the cell decreases and the voltmeter cannot read exact value.

It can be measured accurately by a potentiometer.

46. What is short circuit and open circuit mean to you? **(3 times)**

Ans: when switch is closed and current is passing through the circuit. It is called closed circuit and in this situation resistance is zero whereas the circuit is said to be open if it had infinite resistance and no current is passing through it.

47. Distinguish between electromotive force and terminal potential difference. **(2 times)**

OR What is the difference between electromotive force and terminal potential difference? **(2 times)**

Ans: **Electromotive force:** The energy supplied to a unit charge in moving it from negative to positive electrode inside the source is called electro motive force. The emf is always present even when no current is drawn through the cell.

Terminal potential difference The potential difference across the terminals of a cell or battery when current is being drawn from it is called terminal potential difference.

The potential difference across the conductor is zero when no current flows through it.

48. A potential difference is applied across the ends of a copper wire. What is the effect on the drift velocity of free electrons by decreasing the length and temperature of the wire? **(5 Times)**

Ans: By decreasing the length and temperature of wire, the value of resistance in the wire also decreases which causes an increase in the value of current. Hence, the drift velocity of free electrons also increases.

49. Briefly describe the current through a metallic conductor and drift velocity.

Ans: In a metallic conductor, free electrons are in random motion with the speed of several hundred km/s at the room temperature.

If the ends of wire are connected to a battery, the free electrons experience a force and directed to move in the $-\vec{E}$ direction. The accelerating electrons keep on colliding with atoms of the conductor and transfer their energy to the lattice with the result that the electrons acquire an average velocity, called **drift velocity.**

The drift velocity is of the order of 10^{-3}m/s. A steady current is established in the wire.

50. Under what conditions emf of cell and terminal potential difference become equal. **(2 times)**

Ans: When the switch is open, no current passes through the cell. In this case, the voltmeter reads the emf "E" as terminal potential difference "V_t".

$$E = V_t + Ir$$

Topic VIII: Kirchhoff's Rules:

51. Give statements of Kirchhoff 1st rule and 2nd rule. **(8 times)**

Ans: **Kirchhoff's 1st Rule**

The sum of all currents meeting at a point in the circuit is zero.

$$\sum I = 0$$

Kirchhoff's 2nd Rule

The algebraic sum of all potential changes in a closed circuit is zero.

$$\sum V = 0$$

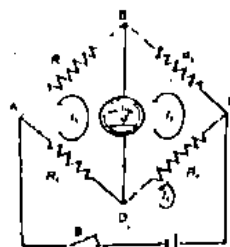
52. Define drift velocity and also write its value at room temperature.

Ans: The drift velocity is the average velocity that an electron attains due to an electric field.

Its value at room temperature is 10^{-3} m/s.

Topic IX: Wheatstone bridge:

53. What is wheat stone bridge? Write down its relation for finding unknown resistance? **(6 times)**

Ans: It is an electrical circuit which can be used to find the unknown resistance of a wire.

It consists of four resistances connected in the form of a mesh, galvanometer, battery and a switch. And unknown resistance can be found as

$$\frac{R_1}{R_2} = \frac{R_3}{R_4}$$

54. Why does no current pass through galvanometer in a balanced wheat stone bridge although the two keys in the circuit are closed?

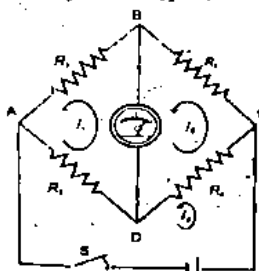
Ans: No current pass through the galvanometer when wheat stone bridge is balanced. Because at this stage, both the terminals of the galvanometer are at the same potential. Hence no current will flow through it.

55. How a Wheatstone bridge is used to determine an unknown resistance? (4 times)

OR What is Wheatstone bridge?

Ans: Wheatstone bridge is an especially designed electrical circuit used to calculate the accurate value of any unknown resistance. It consists of four resistances, a galvanometer, a battery and a switch connected in as shown in fig.

When the switch is closed current passes through galvanometer and then the three known resistances R_1, R_2 and R_3 are adjusted in such a way that galvanometer shows no deflection. In this balanced condition the fourth unknown resistance R_4 can be calculated by using this relation.

$$R_1/R_2 = R_3/R_4$$

Topic X: Potentiometer:

56. Why potentiometer is accurate measuring meter?

Ans: The voltage measured using potentiometer is the voltage across the terminals of the cell when current is not flowing through it. This voltage is exactly the emf of the cell.

Further, the accuracy of a potentiometer can be increased to a great extent by increasing the length of the "potentiometer wire."

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57. A carbon resistance has red, violet, orange and silver colour. What will be its resistance and tolerance?

Ans: The color codes are as follows

$$Red\ 2 \quad 1^{st}\ digit$$
$$Violet\ 7 \quad 2^{nd}\ digit$$
$$Orange\ 3 \quad Number\ of\ zeros$$

Therefore $\quad Resistance = 27000\ \Omega = 27\ k\Omega$

and $\quad Tolerance = \pm 10\ \%$

58. Write the two uses of potentiometer.

Ans: It can be used:

i. to determine the emf of a cell.
ii. to compare the emf of two cells.
iii. as a continuously potential divider.
iv. to measure the internal resistance of the cell.

59. How the comparison of two emfs of cells can be made?

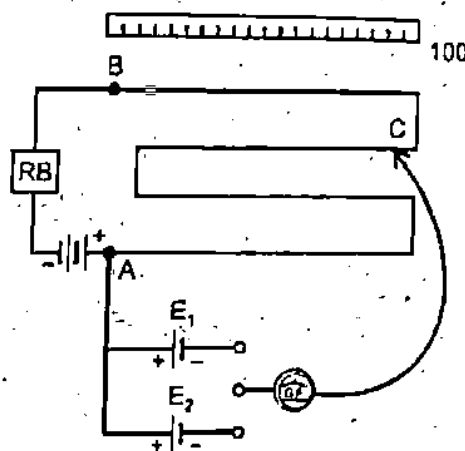
Ans: To compare the emfs E_1 and E_2 of two cells we use the circuit diagram as shown the balancing lengths l_1 and l_2 are found separately for the two cells, then

$$E_1 = \frac{l_1}{L}E \quad .....(i)$$

$$E_2 = \frac{l_2}{L}E \quad .....(ii)$$

Dividing (i) by (ii)

$$\frac{E_1}{E_2} = \frac{l_1 E/L}{l_2 E/L}$$

$$\frac{E_1}{E_2} = \frac{l_1}{l_2}$$

So the ratio of the emfs is equal to the ratio of the balancing lengths.

LONG QUESTION'S OF CHAPTER-13 IN ALL PUNJAB BOARDS 2011-2021

Topic II: Ohm's Law:

1. State and explain Ohm's Law. Also explain the behavior of Ohmic and Non – Ohmic devices with the help of Graphs. **(5 times)**

Topic III: Resistivity and its dependence upon temperature:

2. Define resistivity and explain its dependence upon temperature. Also derive a relation for temperature co-efficient in terms of resistivity. **(2 times)**

Topic VI: Electric Power and Power dissipation in Resistor:

3. Determine the electric power dissipated in a resistor carrying current.
4. Define Electric power. Also explain how power is dissipated in resistors? **(2 times)**

Topic VIII: Kirchhoff's Rules:

5. State Kirchhoff rules and explain the voltage rule.
6. Define Kirchhoff 2nd rule, by applying this rule derive an expression for unknown, resistance by wheat stone bridge.

Topic IX: Wheatstone bridge:

7. What is wheat stone bridge? Describe its construction and working. How can it be used to find the unknown resistance of a wire? **(7 times)**
8. What is Wheatstone bridge? Explain and prove the principle of Wheatstone bridge.

Topic X: Potentiometer:

9. What is potentiometer? Give its construction and how can it be used to find unknown emf. **(2 times)**
10. Describe construction and working of a potentiometer.
11. What is Potentiometer? How it can be used as: **(2 times)**
(i) Potential Divider (ii) Measuring of emf of a cell

Numerical Problems OF CHAPTER-13 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Electric Current:

1. How many electrons are passing through an electric bulb in one minute, If the 300 mA current is passing through it? (7 times)

Ans: Given that $e = 1.6 \times 10^{-19} C$

$t = 1\ min = 60\ s$

$I = 300\ mA = 0.3\ A$

$n = ?$

As $I = \frac{q}{t}$ $\quad I = \frac{ne}{t}$

$n = \frac{It}{e}$

$$n = \frac{0.3 \times 60}{1.6 \times 10^{-19}} = 1.12 \times 10^{20}\ electrons$$

2. A charge of 90 coulombs passes through a wire in one hour and fifteen minutes. What is current in wire? (4 times)

Ans: Given that $q = 90\ C$

$t = 1\ h\ 15\ min$

$t = (60 + 15) \times 60$

$t = 4500\ s$

$I = ?$

As $I = \frac{q}{t}$ $\quad I = \frac{90}{4500} = 0.02\ A$

$$I = 0.02 \times 10^3 \times 10^{-3} A = 20\ mA$$

3. 1.0×10^7 electrons pass through a conductor in $1.0\ \mu s$. Find the current in amperes flowing through the conductor. Electronic charge is $1.6 \times 10^{-19}\ C$. (3 times)

Ans: Given that $n = 1 \times 10^7\ electrons$

$e = 1.6 \times 10^{-19} C$

$t = 1\ \mu s = 1 \times 10^{-6}\ s$

$I = ?$

$I = \frac{q}{t}$

$I = \frac{ne}{t}$

$$I = \frac{1 \times 10^7 \times 1.6 \times 10^{-19}}{1 \times 10^{-6}} = 1.6 \times 10^{-6}\ A$$

Topic II: Ohm's Law:

4. The potential difference between the terminals of a battery in open circuit is $2.2\ volts$. When it is connected across a resistance of 5 Ω. The potential falls to $1.8\ volt$. Calculate the current and the internal resistance of battery. (3 times)

Ans: Given that $E = 2.2\ V$

$R = 5\ \Omega$

$V = 1.8\ V$

$I = ?$

$r = ?$

Since $V = IR$

$$I = \frac{V}{R}$$

$$I = \frac{1.8}{5}$$

$$\boxed{I = 0.36\,A}$$

And $E = V + Ir$

$$r = \frac{E - V}{I}$$

$$r = \frac{2.2 - 1.8}{0.36}$$

$$r = \frac{0.4}{0.36} \boxed{= 1.11\,\Omega}$$

Topic III: Resistivity and its dependence upon temperature:

5. A rectangular bar of iron is 2 cm by 2 cm in cross section and 40 cm long. Calculate its resistance if the resistivity of iron is $11 \times 10^{-8}\,\Omega m$. (9 times)

Ans: Given that $area\ of\ bar = A = 2\,cm \times 2\,cm = 4\,cm^2$

$$A = 4 \times 10^{-4} m^2$$

$$length\ of\ bar = L = 40\,cm = 0.4\,m$$

$$resisitivity\ of\ bar = \rho = 11 \times 10^{-8}\,\Omega m$$

$$resistance = R = ?$$

Since $R = \frac{\rho L}{A}$

$$R = \frac{11 \times 10^{-8} \times 0.4}{4 \times 10^{-4}} \boxed{= 1.1 \times 10^{-4}\,\Omega}$$

6. A platinum wire has resistance of 10 Ω at 0^oC and 20 Ω at 273^oC. Find the value of temperature coefficient of resistance of platinum. (6 times)

Ans: Given that $R_o = 10\,\Omega$

$$R_t = 20\,\Omega$$

$$t_o = 0^oC = 0 + 273 = 273\,K$$

$$t_t = 273^oC = 273 + 273 = 546\,K$$

$$t = t_t - t_o = 546 - 273$$

$$t = 273\,K$$

Since $\alpha = \frac{R_t - R_o}{R_o t}$

$$\alpha = \frac{20 - 10}{10 \times 273}$$

$$\alpha = \frac{10}{10 \times 273}$$

$$\alpha = \frac{1}{273\,K} \boxed{= 3.66 \times 10^{-3} K^{-1}}$$

7. The resistance of an iron core at 0^oC is $1 \times 10^4\Omega$. What is the resistance at 500^oC if the temperature coefficient of resistance of iron is $5.2 \times 10^{-3} K^{-1}$. (9 times)

Ans: Given that $resistance\ at\ 0^oC = R_o = 1 \times 10^4\Omega$

$$resistance\ at\ 500^oC = R_t = ?$$

$$\alpha = 5.2 \times 10^{-3} K^{-1}$$

$$t_o = 0^oC = 0 + 273 = 273\,K$$

$$t_t = 500^oC = 500 + 273 = 773\,K$$

$$t = t_t - t_o = 773 - 273 = 500\,K$$

Since $\alpha = \frac{R_t - R_o}{R_o t}$

$$\alpha R_o t = R_t - R_o$$
$$R_t = \alpha R_o t + R_o$$
$$R_t = (\alpha t + 1)R_o$$
$$R_t = (5.2 \times 10^{-3} \times 500 + 1)1 \times 10^4 \boxed{= 3.6 \times 10^4 \Omega}$$

8. **0.75 A Current flows through an iron wire when a battery of 1.5 $volt$ is connected across its ends. The length of the wire is 5.0 m and its cross-sectional area is $2.5 \times 10^{-7} m^2$. Compute the resistivity of iron. (4 times)**

Ans: Given that $V = 1.5\,V$

$$I = 0.75\,A$$
$$A = 2.5 \times 10^{-7} m^2$$
$$L = 5\,m$$
$$\rho = ?$$

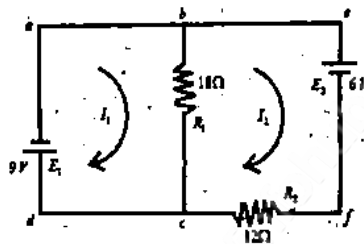
Since $V = IR$

$$R = \frac{V}{I}$$
$$R = \frac{1.5}{0.75}$$
$$R = 2\,\Omega$$

Now $\rho = \frac{RA}{L}$

$$\rho = \frac{2 \times 2.5 \times 10^{-7}}{5} \boxed{= 1 \times 10^{-7}\,\Omega m}$$

Topic VIII: Kirchhoff's Rules:

9. **Find the current which flows in all the resistance of the circuit of figure given below: (2 times)**

Ans: Let I_1 & I_2 are the currents flowing through the loops in clockwise direction.
Applying kirchhoff's 2nd rule to loop abcda,

$$-E_1 + (I_1 - I_2)R_1 = 0$$
$$-9 + (I_1 - I_2)18 = 0$$
$$-9 + 18I_1 - 18I_2 = 0$$
$$-1 + 2I_1 - 2I_2 = 0$$
$$2I_1 - 2I_2 = 1 \quad \text{-------(i)}$$

Applying kircchoff's 2nd rule to loop befcb

$$-E_2 + I_2R_2 + (I_2 - I_1)R_1 = 0$$
$$-E_2 + I_2R_2 + I_2R_1 - I_1R_1 = 0$$
$$-6 + 12I_2 + 18\,I_2 - 18I_1 = 0$$
$$-6 + 30I_2 - 18I_1 = 0$$
$$-18\,I_1 + 30\,I_2 = 6$$
$$-3I_1 + 5I_2 = 1 \quad \text{-------(ii)}$$

Multiplying equation (I) by 3 and equation (II) by 2 and then adding

$$6I_1 - 6I_2 = 3$$
$$-6I_1 + 10I_2 = 2$$

$$4I_2 = 5$$
$$I_2 = \frac{5}{4}$$
$$I_2 = 1.25\,A$$

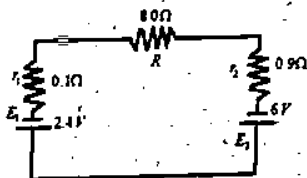
Putting this value in equation (i) $2I_1 - 2(1.25) = 1$

$$2I_1 - 2.5 = 1$$
$$2I_1 = 1.2.5$$
$$2I_1 = 3.5$$
$$I_1 = \frac{3.5}{2} = 1.75\,A$$

Current through the resistor R_1 is $= I_1 - I_2 = 1.75 - 1.25 = 0.5\,A$

Current through the resistor R_2 is $I_2 = 1.25\,A$

Topic VII: Electromotive force and potential difference:

10. **Calculate the terminal potential difference of each cell in the circuit of given fig.**

Ans:

$$E_1 = 2.4\,V, \quad E_2 = 6.0\,v$$
$$r_1 = 0.1\Omega$$
$$r_2 = 0.9\Omega$$
$$R = 8.0\,\Omega$$

As r_1, r_2 & R are connected in series, so their equivalent resistance will be

$$R_e = r_1 + r_2 + R$$
$$= 0.1 + 0.9 + 8.0$$
$$R_e = 9\Omega$$

Effective voltage in the circuit $v_{ef} = E_2 - E_1 = 6.0 - 2.4 = 3.6v$

Current through the circuit $I = \frac{V_{ef}}{R_e} = \frac{3.6}{9} = 0.4\,A$

For battery E_2 current flows through the battery from –ve to +ve terminal, therefore,

$$V_{t1} = E_1 - I\,r_1 = 2.4 - 0.4 \times 0.11 = 2.4 - 0.04 = 2.36v$$
$$V_{t2} = E_2 - (-I)r_2 = E_2 + Er_2 = 6.0 + 0.4 \times 0.9$$
$$= 6.0 + 0.36 = 6.36V$$

11. **The potential difference between the terminals of a battery in open circuit is 22.2V. When it is connected across a resistance of 5.0 Ω, the potential falls to 1.8V. Calculate the current and the internal resistance of the battery.**

Ans: Given that

$$E = 22.2\,V$$
$$R = 5\,\Omega$$
$$V = 1.8\,V$$
$$I = ?$$
$$r = ?$$

Since $V = IR$ $\quad I = \frac{V}{R} = \frac{1.8}{5} \boxed{= 0.36\,A}$

And $E = V + Ir$ $\quad r = \frac{E - V}{I}$

$$r = \frac{22.2 - 1.8}{0.36} = \frac{20.4}{0.36} \boxed{= 56.67\,\Omega}$$

OBJECTIVES (MCQ'S) OF CHAPTER-14 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Magnetic Field due to current in a straight long wire:

1. The fact that the electric current produces magnetic field was discover by:
(A) Newton (B) Maxwell (C) Henry (D) Oersted

2. If we make magnetic field stronger, the value of induced current is:
(A) Decreased (B) Increased (C) Vanished (D) Kept constant

3. The unit of magnetic field, $\vec{B}$ in a system international is:
(A) Weber (B) Tesla (C) Gauss (D) Newton

4. Two parallel wires carrying current in the same direction: **(7 times)**
(A) Attract each other (B) repel each other
(C) Cancel their fields (D) no effect on each other

5. The unit of $\vec{E}$ is NC^{-1} and that of $\vec{B}$ is $NA^{-1}m^{-1}$, the unit of E/B is: **(2 times)**
(A) ms^{-2} (B) ms (C) ms^{-1} (D) $m^{-1}s^{-1}$

Topic II: Force on a current carrying conductor in a uniform magnetic field:

(4 Times)

6. The magnetic force is simply a:
(A) Reflecting force (B) Deflecting force (C) Restoring force (D) Gravitational force

7. If the number of turns become double but length remain same, then magnetic field in the solenoid become.
(A) Zero (B) remain same (C) half (D) double

8. A current carrying conductor experiences maximum magnetic force in a uniform magnetic field when it is placed.
(A) Perpendicular to field (B) Parallel to field
(C) At an angle of 60° to the field (D) At an angle of 180° to the field

Topic III: Magnetic Flux and Flux Density:

9. Tesla can be written as: **(4 times)**
(A) NAm^{-1} (B) $NA^{-1}m^{-1}$ (C) $N^{-1}Am^{-1}$ (D) $NA^{-1}m$

10. A metal rod of length 1m is moving at a speed of $1ms^{-1}$ in a direction making an angle of $30°$ with 0.5T magnetic field. The emf produce is:
(A) 0.25N (B) 0.25V (C) 2.5V (D) 2.5N

11. Magnetic density at a point due to the current carrying conductor be determined by: **(5 times)**
(A) Ampere's law (B) Faraday's law (C) Newton's law (D) Lenz's law

12. SI unit of magnetic flux is: **(2 times)**
(A) Wb (B) Wbm^{-2} (C) Wbm^{-1} (D) T

13. Magnitude of the motional emf induced in a conducting bar of length L moving through a magnetic field B with velocity V is:
(A) $\varepsilon = BvL$ (B) $\varepsilon = BvL\cos\theta$ (C) $\varepsilon = BvL\sin\theta$ (D) $\varepsilon = Bv/L$

14. Magnetic flux density is measured in: **(2 times)**
(A) Weber (B) Weber/m^2 (C) Tesla – m (D) Gauss

15. The magnetic flux ϕ_B is equal to:
(A) $\vec{B}.\vec{A}$ (B) $\vec{B}\times\vec{A}$ (C) $\frac{B}{A}$ (D) BA Sinθ

16. The SI unit of magnetic induction is: **(3 times)**
(A) Weber (B) Tesla (C) Newton (D) Weber per meter

17. The unit of magnetic flux: **(2 times)**
(a) NmA^{-1} (b) $Nm^{-1}A$ (c) $Nm^{-1}A^{-1}$ (d) NmA

18. 1 tesla is equal to: **(2 times)**
(a) 1 NmA^{-1} (b) 1 $Nm^{-1}A^{-1}$ (c) 1 Nm^{-1} (d) 1 $Nm^{-2}A^{-1}$

19. S.I. Unit of E is NC^{-1} and that of B is $NA^{-1}m^{-1}$, then the unit of $\frac{E}{B}$ is:
(A) $m^{-1}s^{-1}$ (B) ms^{-1} (C) ms^{-2} (D) ms

20. If the coil is wound on an iron core, the magnetic flux through it will:
(A) Zero (B) Increases (C) Decreases (D) Ramain constant
21. Energy stored per unit volume in magnetic field is called:
(A) Electric flux (B) Energy density (C) Work (D) Power

Topic IV: Ampere's Law:

22. $\sum_{r=1}^{N}(B.\Delta L)_r = \mu_o I$ is the relation for: **(2 times)**
(A) Millikan's law (B) Gauss's law (C) Ampere's law (D) Lenz's law
23. The field inside a solenoid is given by:
(A) $\mu_o nI$ (B) $\mu_o n^2 I$ (C) $\mu_o nI^2$ (D) $\mu_o NI$
24. In current carrying long solenoid the magnetic field produced does not depend upon.
(A) The radius of solenoid (B) Number of turns per unit length
(C) Current flowing through solenoid (D) All of above
25. The magnetic inside a current carrying long solenoid is:
(A) Non-uniform (B) Weak (C) Uniform and strong (D) Zero

Topic V: Force on a moving charge in a uniform magnetic field:

26. Direction of the vector $\vec{L} \times \vec{B}$ is same as:
(A) Force (B) Magnetic field (C) Electric field (D) Length of conductor
27. Magnetic force on a moving charged particle is perpendicular to the ______:
(A) Magnetic field (B) Electric field (C) Velocity of the particle (D) A and C both
28. In equation $\varepsilon = -VBL\sin\theta$, θ is angle between:
(A) I and B (B) V and B (C) V and L (D) L and B
29. If a charge is free to move in an electric field, then acceleration will be:
(A) $\frac{qE}{m}$ (B) qEm (C) $\frac{q}{Em}$ (D) $\frac{m}{qE}$
30. Force on a moving charge in a uniform magnetic field will be maximum, when the angle between V and B is:
(A) 0° (B) 30° (C) 60° (D) 90°
31. An electron of mass 'm' and charge 'e' is moving in a circle of radius 'r' with speed 'v' in a uniform magnetic field of strength B. then:
(A) $r \propto m$ (B) $r \propto B$ (C) $r \propto \frac{1}{v}$ (D) $r \propto \frac{1}{m}$
32. A positively charged particle of certain mass may be held suspended (at rest) in electrical field of suitable strength if the field is directed:
(A) Outward (B) Inward (C) Upward (D) Downward
33. The unit of permeability (μ_o) of free space is:
(A) Wbm^{-2} (B) $WbmA^{-1}$ (C) $WbA^{-1}m^{-1}$ (D) $WbAm^{-1}$
34. Work done on charged particle moving in uniform magnetic field is: **(3 times)**
(A) Maximum (B) Zero (C) Minimum (D) Negative
35. The value of permeability of free space in SI unit is: **(4 Times)**
(A) $4\pi \times 10^{-9} WbA^{-1}m^{-1}$ (B) $4\pi \times 10^{-7} WbA^{-1}m^{-1}$
(C) $4\pi \times 10^{-10} WbA^{-1}m^{-1}$ (D) $4\pi \times 10^{7} WbA^{-1}m^{-1}$
36. Millikan and flecher could determine the charge on oil droplets in:
(A) Thermal equilibrium (B) Electrical equilibrium
(C) Mechanical equilibrium (D) Unstable equilibrium
37. If a charge is at rest in a magnetic field then force on charge is: **(3 times)**
(A) Zero (B) $q(\bar{V} \times \bar{B})$ (C) $qVB\sin\theta$ (D) $qVB\cos\theta$

38. If F_1 and F_2 are forces acting on α-Particle and electron respectively, when moving perpendicular to the magnetic field then: (2 times)
(A) $F_1 = F_2$ (B) $F_1 > F_2$ (C) $F_1 < F_2$ (D) $F_1 = 4F_2$

39. An electron enters the magnetic field at right angle from left, B is into paper. The electron will be deflected:-
(a) Upward (b) Towards right (c) Downward (d) Towards left

40. When a charge is projected perpendicular to a uniform magnetic field, its path:
(a) Spiral (b) helix (c) ellips (d) circular

41. The charges moving perpendicular to magnetic field experience force:
(a) Maximum (b) minimum (c) zero (d) infinite

42. Force on moving charge in a magnetic field is given by:
(A) $F = q(\overline{B} \times \overline{V})$ (B) $\vec{F} = q(\overline{V} \times \overline{B})$ (C) $F = q(\overline{B} + \overline{V})$ (D) $F = q(\overline{B} - \overline{V})$

43. Which one of the following particles moving in the magnetic field cannot be deflected:
(A) α - particle (B) β - Particle (C) Electron (D) Neutron

44. A 5m wire carrying a current of 2A is at right angle to the uniform magnetic field of 0.5 weber/m². The force on the wire is:
(A) 2N (B) 4N (C) 5 N (D) 1.5 N

Topic VI: Motion of charge particle in electric and magnetic field:

45. The Lorentz force on a charged particle moving in electric field E and magnetic field B is given by: (3 times)
(A) $F = F_E + F_B$ (B) $F = F_E - F_B$ (C) $F = \frac{F_B}{F_E}$ (D) $F = F_B F_E$

46. The sum of electric and magnetic force is called:
(A) Maxwell force (B) Lorentz force (C) Newton's Force (D) Centripetal force

Topic VII: Determination of e/m value of an electron:

47. Charge to mass ratio of Neutron is: (4 Times)
(A) 1.758×10^{-11} C/kg (B) 9.58×10^{7} C/kg
(C) 1.758×10^{11} C/kg (D) Zero

48. $\frac{e}{m}$ of an electron is:
(A) $\frac{B^2r^2}{2V}$ (B) $\frac{Br^2}{2V}$ (C) $\frac{2V}{B^2r^2}$ (D) $\frac{2V^2}{B^2r^2}$

49. The value of e/m is smallest for: (3 times)
(a) Proton (b) Electron (c) β-particle (d) Positron

50. $\frac{e}{m}$ of an electron is given by:
(A) $9.11 \times 10^{-31} \frac{c}{kg}$ (B) $1.61 \times 10^{-19} \frac{c}{kg}$ (C) $1.71 \times 10^{11} \frac{c}{kg}$ (D) $1.7 \times 10^{-11} \frac{c}{kg}$

Topic VIII: Cathode Ray Osciloscope:

51. The brightness of the input on CRO screen is controlled by: (8 Times)
(A) Cathode (B) Anode (C) Grid (D) Plato

52. In CRO, the output wave form of time base generator is: (3 times)
(A) Circular (B) Square (C) Sinusoidal (D) Saw-tooth

53. The CRO is used for:
(A) Displaying wave form of frequency (B) Displaying wave form of given vibration
(C) Converting A.C into D.C (D) Displaying wave form of given voltage

54. The velocity of an oscillating charge as it moves to and fro along the wire is:
(a) Changing (b) Constant (c) Infinite (d) Zero

55. Cathode Ray Oscilloscope works by deflecting beam of: (4 times)
(A) Neutrons (B) electrons (C) Protons (D) Positrons

56. Filament in C.R.O:
(A) Conductors (B) Insulators (C) Perfect conductors (D) Perfect insulators

57. If an electron of charge 'e' is accelerated through a potential difference v, it will acquire energy:
(A) Ve (B) V/2 (C) E/V (D) Ve²
58. The function of three anodes in a C.R.O is.
(A) To accelerate electrons only (B) To focus the electrons only
(C) To control the brightness of spot on screen (D) To accelerate and focus the electrons

Topic IX: Torque on a current carrying coil:

59. The relation for maximum value of deflecting couple is given by:
(A) $\tau = B\ NLI$ (B) $\tau = BINA$ (C) $\tau = BNA$ (D) $\tau = BNA\sin\theta$
60. The grid in the cathode ray oscilloscope:
(A) Controls number of waves (B) Controls the brightness of spot formed
(C) Has positive potential with respect to cathode (D) Accelerates electrons
61. Beam of electrons are also called:
(A) Positive rays (B) X-rays (C) Cathode rays (D) Cosmic rays
62. Direction of torque on a current carrying coil is:
(A) Clock wise (B) Anti clock wise
(C) Regular reversal of clock and anti-clock wise (D) No direction
63. The couple C for the unit twist of the suspension wire can be decreased by:
(A) Increasing its length (B) Decreasing its length
(C) Increasing its diameter (D) It cannot be decreased
64. Torque on a current carrying coil has the equation:
(A) $\tau = q(V \times B)$ (B) $\tau = BILq$ (C) $\tau = BINA\cos\alpha$ (D) $\tau = NLAB\cos\alpha$
65. Torque is produced in a current carrying coil when it is placed in a:
(A) Magnetic field (B) Electric field (C) Gravitational field (D) Nuclear field
66. Torque on a current carrying coi is given by:
(a) ILB cos α (b) ILB cos sin α (c) IBA cosα (d) IBA sin α

Topic X: Galvanometer:

67. Instrument used for the detection of the current:
(A) Galvanometer (B) Ammeter (C) Voltmeter (D) Ohmmeter
68. Which of the following is likely to have lowest resistance: **(2 times)**
(A) Ammeter (B) Galvanometer (C) VTVM (D) Voltmeter
69. A galvanometer becomes more sensitive when the factor C/BAN will be: **(2 times)**
(A) Large (B) Small (C) Constant (D) Zero
70. The high resistance R_h that should be connected in series with the galvanometer of resistance Rg to convert it into a voltmeter of range o-v volts is given by:
(A) $\frac{V}{I_g} + Rg$ (B) $\frac{I_g}{V} - Rg$ (C) $\frac{I_g R_g}{V - I_g}$ (D) $\frac{V}{I_g} - Rg$
71. A shunted galvanometer is called:
(A) Ohmmeter (B) Ammeter (C) Voltmeter (D) Potentiometer
72. Ammeter is used to measure:
(A) Resistance (B) Voltage (C) Current (D) Capacitance
73. A voltmeter is always connected in circuit to measure the P.D in:
(A) Parallel (B) Series (C) Perpendicular (D) Straight line
74. A proper combination of a galvanometer and resistance in series acts as:
(A) Voltmeter (B) Ammeter (C) Ohmmeter (D) Avometer
75. If a high resistance is connected series to a galvanometer, then galvanometer is converted into:
(A) Ammeter (B) Voltmeter (C) Ohm meter (D) multi meter
76. The sensitivity of galvanometer can be increased by: **(3 times)**
(A) decreasing the area of coil (B) Decreasing the number of turns of coi
(C) Increasing the magnetic field (D) Using a fine suspension
77. Method "Lamp and scale arrangement" is used to measure the.
(A) Voltage (B) Current (C) Torque (D) Angle of deflection
78. Shunt resistance is: **(2 times)**
(A) Low resistance (B) High resistance (C) Zero resistance (D) Impedance

79. Which one of the following Resistance is used to Convert a Galvanometer into an Ammeter:
(A) High Resistance (B) Low Resistance in Series with Galvanometer
(C) Shunt (D) High Resistance in Series with Galvanometer

80. Current passing through the coil of galvanometer.
(A) $\frac{C\theta}{BAN}$ (B) $\frac{C\theta}{BA}$ (C) $\frac{NAB}{C\theta}$ (D) $\frac{AN}{BC\theta}$

81. A battery is used in:
(A) Ohm meter (B) ammeter (C) Galvanometer (D) Voltmeter

Topic XI: Avometer:

82. In AVO meter the current is measure when number of low resistances are connected with galvanometer in:
(A) Series (B) Parallel (C) Series and parallel (D) Perpendicular

83. Useful device to measure resistance current and voltage is an electronic instrument called:
(A) Voltmeter (B) Ammeter (C) Ohmmeter (D) Digital Multimeter

84. An AVOmeter can also be called as:
(A) Digital multimeter (B) Digital voltmeter (C) Digital ammeter (D) Digital ohm-meter

85. 1 Wbm^{-2} is equal to: (2 Times)
(A) 10^3Gauss (B) 10^6Gauss (C) 10^4Gauss (D) 10^5Gauss

86. In CRO the number of electrons is controlled by operating:
(A) Anodes B) Cathodes (C) Grid (D) Filament

87. The Lenz's law fulfils:
(a) Law of conservation of energy (b) law of conservation of charge
(c) Law of conservation of Momentum (d) Kirchhoff's law

2018

88. For a current carrying solenoid the term "n" has units as: (2 times)
(a) No unit (b) m^{-1} (c) m^{-2} (d) m^{-3}

89. The magnetic force on an electron, travelling at 10^6 m/s parallel to the field of strength 1 Weber /m^2 is: (3 times)
(a) 10^{-12} N (b) Zero (c) 10^3N (d) 16×10^{-12}N

90. A positive charge is moving towards an observer. The direction of magnetic induction will be:
(A) towards right (B) clock wise (C) anti clock wise (D) towards left

91. A charged particle having charge q is moving at right angle to magnetic field. The quantity which varies is:
(A) speed (B) kinetic energy (C) path of motion (D) Angular velocity

92. The force on current carrying conductor placed in magnetic field is expressed by:
(A) $\vec{F} = I\vec{L}.\vec{B}$ (B) $\vec{F} = I\vec{L} \times \vec{B}$ (C) $\vec{F} = I^2\vec{L} \times \vec{B}$ (D) $\vec{F} = I\vec{B} \times \vec{L}$

93. Two parallel wires carrying currents in opposite direction: (2 times)
(A) Repel each other (B) Attract each other
(C) Neither attract nor repel each other (D) Stick to each other

94. A current carrying conductor is placed in uniform magnetic field parallel to it. The magnetic force experienced by the conductor is:
(A) F = ILB (B) F = ILB sinθ (C) F = ILB cosθ (D) F is zero

95. If length of Solenoid is doubled but N same, $\vec{B}$ inside the Solenoid becomes:
(A) Half (B) Double (C) One Fourth (D) Four Times

96. A 50 mH coil carries a current of 2 Amp. The energy stored in its magnetic field is:
(A) 0.05 J (B) 0.1 J (C) 10 J (D) 50 J

97. The current flowing towards the reader can be represented by a symbol:
(A) Dot (B) Dash (C) Cross (D) Line

98. If current flowing through a solenoid becomes four times, then magnetic field inside it becomes:
(A) two times (B) three times (C) four times (D) half

99. The SI unit of flux density is: (2 times)
(A) $Nm^{-1}A^{-2}$ (B) $NA^{-1}m^{-1}$ (C) NAm^{-1} (D) $NA^{-1}m$

100. Two parallel wires carrying current in the opposite directions:
(A) may repel or attract each other (B) attract each other
(C) have no effect on each other (D) repel each other

2019

101. Magnetic field of 0.5 T is parallel to vector area of $1m^2$ of a coil, flux through the coil is:
(A) Zero (B) 5 web (C) 0.2 web (D) 0.5 web

102. The brightness of spot in CRO is controlled by: (2 times)
(A) Cathode (B) Anode (C) Grid (D) Deflecting plates

103. The brightness of spot on CRO screen is controlled by:
(A) Anode (B) Cathode (C) Grid (D) Plates

104. S.I unit of magnetic permeability is:
(A) $Wb\ A^{-1}\ m^{-1}$ (B) $Wb\ m^2$ (C) $Wb\ mA^{-1}$ (D) $Wb\ Am^{-1}$

105. When ohmmeter gives full scale deflection, it indicates,
(A) Zero resistance (B) infinite resistance
(C) Small resistance (D) very high resistance

106. Formula for magnetic field due to solenoid is given by:
(A) $\mu_o I$ (B) $\mu_o nI$ (C) $\mu_o SI$ (D) $\mu_o nI$

107. The relation $B=\frac{\mu_o I}{2\pi r}$ is called:
(A) Ampere's law (B) Faraday's law (C) Lenz's law (D) Gauss's law

108. A 5m wire carrying current 2 A at right angle to uniform magnetic field of 0.5 T. The force on the wire is:
(A) 1.5 N (B) 5 N (C) 2.5 N (D) 4 N

109. When a charged particle is projected opposite to the direction of magnetic field, it experiences a force equl to:
(A) $quB\cos\theta$ (B) $quB\sin 90^o$ (C) quB (D) zero

110. In order to increase the range of voltmeter R_H is:
(A) Increased (B) Decreased (C) Unchanged (D) Increased bty 4 times

111. The Force acting in a particle moving under the influence of both Electric and Magnetic Field is equal to:
(A) $F = F_e - Fm$ (B) $F = F_e + Fm$ (C) $F = F_e \times Fm$ (D) $F = F_e / Fm$

112. The magnetic induction has the same unit as of:
(A) Flux (B) Flux density (C) Electric intensity (D) Magnetization

2021

113. When a charge is projected perpendicular to a uniform magnetic field, then its path followed will be
(A) Straight line (B) Circle (C) Elipse (D) Helix

114. An electron is moving in a circle of radius "r" in a uniform magnetic field, suddenly the field is reduced to B/2, the radius of circle now becomes:
(A) $\frac{r}{2}$ (B) $\frac{r}{4}$ (C) $2r$ (D) 4r

115. A power line 10 m high carries a current 200A. The magnetic field of the wave at eh ground is:
(A) $4\times10^{-6}T$ (B) $40\times10^{-6}T$ (C) $4\times10^{-4}T$ (D) $4\times10^{-3}T$

116. An Electric Circuit in CRO that provides voltage to x plates is called:
(A) Tweet (B) Sweep (C) Sleep (D) Cheep

117. In the expression $\frac{e}{m}=\frac{V}{Br}$, the radius is measured by making electronic trajectory
(A) Hyperbolic (B) Ellipse (C) Dark (D) Visible

118. When a charged particle is projected at right angle to the magnetic field, the magnitude of the magnetic force on charged particle is:
(A) infinite (B) maximum (C) zero (D) negligible

119. If 300 turns of wire are wound on $30cm$ length, then number of turns per unit length is:

(A) 10 (B) 20 (C) 100 (D) 1000

120. Magnetic field strength is measured in terms of:

(A) Wbm^{-2} (B) Wb (C) NmA^{-1} (D) Js

121. Force on current carrying conductor per unit length is given by:

(A) ILB sin θ (B) ILB (C) IB (D) IB sin θ

122. The Ratio of Magnetic Force (Fm) and Electric Force (Fe) acting on a charge moving undeflected through the field is:

(A) E/B (B) B/E (C) 1 (D) $\frac{E}{vB}$

ANSWERS OF THE MULTIPLE CHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
D	B	B	A	C	B	D	A	B	B	A	A	C	B	A
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
B	A	B	D	B	B	C	A	A	C	B	D	B	A	D
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
A	C	C	B	B	B	A	B	A	D	A	B	D	C	A
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
B	D	C	A	C	C	D	D	A	B	A	A	D	B	B
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
C	A	A	C	A	C	A	A	B	D	B	C	A	A	B
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
C	D	A	C	A	A	B	D	A	C	C	A	B	B	C
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
C	B	A	D	A	B	A	C	B	D	D	C	C	A	A
106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
B	A	A	D	A	B	B	B	C	A	B	D	B	D	A
121	122													
D	C													

SHORT QUESTIONS OF CHAPTER-14 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Magnetic Field due to current in a straight long wire:

1. Can a charge at rest be set into motion by bringing a magnet close to it?

Ans: No a charge at rest cannot be set into motion by bringing a magnet close to it Because $\vec{F} = q(\vec{v} \times \vec{B})$ only acts on moving charges.

2. On what factors the induced currents due to motional emf depend?

Ans: The current can be increased by the following factors:

i. Using a stronger magnetic field

ii. Moving The loop faster

iii. Replacing the loop with a coil of many turns.

3. State the right hand palm rule.

Ans: If the middle finger of the right hand points in the direction of the magnetic field the thumb in direction of current, the force on the conductor will be normal to the palm towards the reader.

4. Define electromagnetism and give the name of one device in which electromagnetism is used.

Ans: The branch of physics which deals with electricity and magnetism and the interaction between them is known as electromagnetism.

Electromagnetism is used in door bells, electric motors such as electric fan etc.

5. How might a loop of wire carrying a current be used as compass? How could such a compass distinguish between north and south pole?

Ans: A current carrying loop of wire generates a magnetic field which acts like the magnetic field of a small magnet. North and south poles of this magnet are found by right hand rule.

The magnetic compass shows the magnetic north and south poles which is aligned according to the earth's magnetic field.

6. What is right hand rule to find the direction of the lines of force?

Ans: Right had grip rule states that hold the solenoid in the right hand with fingers curling in the direction of the current, the thumb will point in the direction of the magnetic field lines or lines of force.

Topic II: Force on a current carrying conductor in a uniform magnetic field:

7. Define Tesla and write its formula. **(2 times)**

Ans: If a magnetic field exerts a force of 1N on 1m length of the conductor placed at right angles to the magnetic field carrying a current of 1A then the strength of magnetic field is said to be one tesla.

$$1\ T = 1\ NA^{-1}m^{-1}$$

Topic III: Magnetic Flux and Flux Density:

8. Describe the change in magnetic field inside a solenoid carrying a steady current I, if the length of the solenoid is double but the number of turns remains the same. **(7 Time)**

Ans: The magnetic field strength inside a current carrying solenoid is

$$B = \mu_0 nI$$

$$B = \frac{\mu_0 NI}{L}$$

By applying given conditions

$$B' = \frac{\mu_0 NI}{2L}$$

$$B' = \frac{B}{2}$$

Thus on doubling the length of solenoid by keeping the turns constant, the magnetic field strength becomes one half of its original value.

9. A plane conducting loop is located in a uniform magnetic field that directed along the x-axis. For what orientation of the loop is the flux maximum? For what orientation is the flux minimum? **(6 times)**

Ans: Magnetic Flux is given as $\Phi_B = \vec{B}.\vec{A} = BA\cos\theta$

i. When vector area of the conducting loop is in the direction of magnetic field strength then flux will be maximum.

$$\Phi_B = BA\cos 0^o$$

$$\Phi_B = BA$$

i. When vector area of the conducting loop is perpendicular to magnetic field strength then flux will be minimum.

$$\Phi_B = BA\cos 90^o$$

$$\Phi_B = 0$$

10. Define magnetic flux give its unit. **(2 times)**

Ans: The number of magnetic lines of force passing through certain area element is called magnetic flux. Mathematically,

$$\Phi_B = \vec{B}.\vec{A}$$

$$\Phi_B = BA\cos\theta$$

Magnetic flux is a scalar quantity and its SI unit is NmA^{-1} which also called $weber\ (Wb)$.

11. Distinguish between magnetic flux and magnetic flux density. Write their SI units.

OR Define magnetic flux and magnetic flux density. **(12 times)**

Ans: __Magnetic flux__: The number of magnetic lines of force passing through certain element of area is called magnetic flux. Magnetic flux is a scalar quantity and its SI unit is NmA^{-1} which is also called $weber\ (Wb)$.

Magnetic flux density: The magnetic flux per unit area of a surface perpendicular to magnetic field is called magnetic flux density. Its SI unit is $Nm^{-1}A^{-1}$ which is also called *tesla* (T).

12. Define Energy density and give its equation.

Ans: The magnetic energy stored in the inductor per unit volume is referred as energy density. Mathematically, $U = \frac{1}{2}\frac{B^2}{\mu_o}$

13. Define magnetic flux and solenoid.

Ans: The number of magnetic field lines passing through a certain element of area is known as magnetic flux through that surface.

A solenoid is a long, tightly wound, cylindrical coil of wire. When current passes through such a coil, it behaves like a bar magnet.

14. Define magnetic flux and mention the factors upon which it depends.

Ans: The number of magnetic lines of force passing through certain element of area is called its magnetic flux.

$$\phi_B = \vec{B} \cdot \vec{A} = BA\cos\theta$$

It depends upon magnetic field intensity B, flat surface area A and an angle θ between the normal to the surface and a magnetic field.

15. Define magnetic flux and one tesla. **(2 times)**

Ans: The number of magnetic field lines passing through a certain element of area is known as **magnetic flux** through that area.

A magnetic field is said to have a strength of **one tesla** if it exerts a force of one newton on one meter length of the conductor placed at right angles to the field when a current of one ampere passes through the conductor.

16. Define magnetic induction and tesla. **(2 times)**

Ans: When a conductor is moved through a magnetic field, the electric current flow through the circuit. The emf produced in the conductor is called induced emf, and the current generated is called induced current. This phenomenon is called **electromagnetic induction.**

A magnetic field is said to have a strength of **one tesla** if it exerts a force of one newton on one meter length of the conductor placed at right angle to the field when a current of one ampere passes through the conductor.

Topic IV: Ampere's Law:

17. Describe change in magnetic field inside a solenoid carrying steady current I if the number of turns is double but the length remain same. **(5 Times)**

Ans: The magnetic field strength inside a current carrying conductor is

$$B = \mu_0 nI$$

$$B = \frac{\mu_0 NI}{L}$$

By applying given conditions $\quad B' = \frac{\mu_0 (2N)I}{L}$

$$B' = 2B$$

Thus on doubling the number of turns of solenoid by keeping its length constant, the magnetic field strength becomes doubled of its original value.

18. What is Lorentz force? Give the role of electric and magnetic force in this regard. **(2 times)**

Ans: The vector sum of electric force and magnetic force is called Lorentz force.

$$\vec{F} = \vec{F_e} + \vec{F_b}$$

$$\vec{F} = q\vec{E} + q(\vec{v} \times \vec{B})$$

Only the electric force does work, while no work is done by the magnetic force which is simply a deflecting force.

19. A current in a conductor produces a magnetic field, which can be calculated by using Ampere's law. Since current is defined as the rate of flow of charge, what can you conclude about the magnetic field due to stationary charges? What about moving charges?

Ans: In case of stationary charges, the rate of flow of charges is zero. $I = 0$
So there will be no magnetic field.
But, The moving charges produce current, so the magnetic field produced around the path of its motion similar to the magnetic field produced around a current carrying conductor.

20. Why is B non-zero outside a solenoid?

Ans: The magnetic field outside a solenoid is not zero. This is only true for an infinitely (thus unreal) long solenoid.
Infinitely long solenoids cannot be found in nature. The magnetic field outside a real solenoid is less dense than inside the solenoid and often one is only concerned with the field inside, which is approximately constant.

21. State ampere's law. Write down its formula. (6 times)

Ans: Ampere's law states that the sum of the quantities $\vec{B}.\overrightarrow{\Delta L}$ for all path elements into which the complete loop has been divided equals μ_o times the total current enclosed by the loop.

According to Ampere's law, $\sum_{r=1}^{N} \vec{B}.\overrightarrow{\Delta L} = \mu_o I$

22. Why does the picture on a TV screen become distorted when a magnet is brought near the screen? (28 Times)

Ans: As we know that when charges are moving in a certain region, a magnetic field is existed around the charges due to the flow of current.
The electrons emitted from electron gun produce their own magnetic field when they are moving towards the screen of the television. When a magnet is brought near the screen, the electrons emitting from the electron gun experience an external magnetic force $\vec{F} = q\,(\vec{v} \times \vec{B})$ and hence are deflected. Due to their change of path by outer magnet the picture will be distorted.

23. At a given instant, a proton moves in positive x direction in a region where there is a magnetic field in the negative z direction. What is direction of magnetic force?

Ans: As we know that the magnitude of magnetic force $\vec{F}$ acting on a charge moving with velocity $\vec{v}$ inside a magnetic field $\vec{B}$ is given by,

$$\vec{F} = q\,(\vec{v} \times \vec{B})$$

According to Right Hand Rule, the direction of force $\vec{F}$ is perpendicular to the plane containing $\vec{v}$ and $\vec{B}$. As proton is moving along x-axis, magnetic field is directed along z-axis, therefore, the magnetic force will be directed along y-axis.

24. Give dimensions of permeability of free space μ_o.

Ans: From Ampere's law, for a solenoid

$$B = \mu_o n I$$

$$\frac{F}{IL} = \mu_o \frac{N}{L} I$$

$$\mu_0 = \frac{F}{NI^2}$$

$$[\mu_o] = \frac{[F]}{[N][I]^2}$$

number of turns "N" being a constant is dimensionless, so

$$[\mu_o] = \frac{[MLT^{-2}]}{[I]^2}$$

$$[\mu_o] = [MLT^{-2}]\,[I^{-1}]^2$$

$$[\mu_o] = [MLT^{-2}I^{-2}]$$

25. Is it possible to obtain an isolated north pole? Give reason.
Or Why is it impossible to have an isolated north or south pole of magnet? Explain.

Ans: No.
The source of magnetism of an atom is the electrons. Accepting this view of magnetism it is concluded that it is impossible to obtain an isolated north pole. The north pole is merely one side of a current loop. The other side will always be present as a south pole and these cannot be separated. This is an experimental reality
Saw-tooth voltage increases linearly with time for a period T and then drops to zero as shown in figure above.

Topic V: Force on a moving change in a uniform magnetic field:

26. If a charge particle moves in a straight line through some region of space, can you say that magnetic field in the region is zero? (13 Times)

Ans: The magnitude of magnetic force on a charge particle is

$$F = qvB\sin\theta$$

Magnetic force will be zero due to the following reasons
i. Magnetic field strength B in the region is zero.
ii. Magnetic field is parallel or anti-parallel to the direction of motion.

27. Two charged particle are projected into a region where there is a magnetic field perpendicular to their velocities. If the charge is deflected in opposite directions, what you can say about them? (6 Times)

Ans: When a charged particle is projected in a magnetic field, it will experience the magnetic force i.e. $\vec{F_b} = q(\vec{v} \times \vec{B})$
The magnetic force is a deflecting force. Thus if the charged particles are deflected in opposite direction, then particles are oppositely charged. i.e., one particle is positively charged and the other is negatively charged.

28. How can you use a magnetic field to separate isotopes of chemical element? (24 Times)

Ans: Since isotopes of an element have same charge number but different mass number.
As we know that the radius of a charged particle inside a magnetic field is given as, $r = \frac{mv}{qB}$ or $r \propto m$
It shows that the isotopes projected from the same point at right angle to the magnetic field B will follow circular path of different radii due to their different masses. So, they can be distinguished easily.

29. Two charged particles are projected into a region where there is a magnetic field perpendicular to their velocities. If the charges are deflected in opposite directions, what can you say about them?

Ans: If two charged particles passing through a uniform magnetic field are deflected in opposite directions then both of them are oppositely charged i.e. one is positively and the other negatively charged.

30. Can a charged particle move through a magnetic field without experiencing any magnetic force? If so then how?

Ans: Yes, if a charged particle is moving parallel to magnetic field then magnetic force on it will be zero.
As $\vec{F} = q(\vec{v} \times \vec{B})$
$\Rightarrow F = qvB\sin 0^\circ = qvB(0) = 0$

Topic VI: Motion of charge particle in electric and magnetic field:

31. Suppose that a charge 'q' is moving in a uniform magnetic field with a velocity V. Why is there no work done by the magnetic force that acts on the charge 'q'. (7 Times)

Ans: Work done is given as $W = \vec{F}.\vec{d} = Fd\cos\theta$

The magnetic force on a charged particle will act normal to the direction of motion of the particle i.e. $\vec{F} = q(\vec{v} \times \vec{B})$

$$F = qvB$$

So $\theta = 90^o$

and $W = Fd\cos 90^o$

$$W = 0$$

Thus we can say that magnetic force is a deflecting force and it cannot do any work.

32. Define Lorentz Force. Write its formula. **(14 Times)**

OR What is Lorentz Force?

Ans: The combined effect of electric force and magnetic force exerted on charged particle is called Lorentz force. Mathematically,

$$\vec{F} = \vec{F_e} + \vec{F_b}$$

$$\vec{F} = q\vec{E} + q(\vec{v} \times \vec{B})$$

Only the electric force does work, while no work is done by the magnetic force which is simply a deflecting force.

Topic VIII: Cathode Ray Osciloscope:

33. Briefly give the function of Filament, Cathode, Gird and plates in C.R.O.

Ans: **Filament:** It heats the cathode.

Cathode: It emits electrons.

Grid: It controls the number of electrons (brightness).

Plates: The two sets of plates are used to deflect the beam of electrons along x-axis and y-axis.

34. Write any two uses of CRO. **(15 Times)**

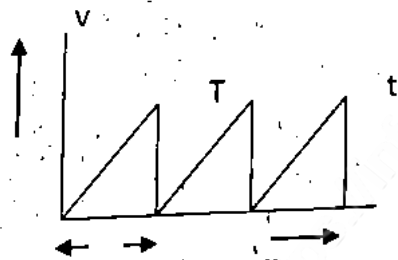
Ans: i. The CRO is used for displaying the waveform of a given voltage.

ii. Once the waveform is displayed, we can measure the voltage, its frequency and phase.

35. What is the function of grid in cathode ray oscilloscope? **(8 Times)**

Ans: Grid is at negative potential relative to cathode. It controls the number of electrons reaching the screen and thus controls the brightness of spot on the screen.

36. Draw Saw tooth voltage wave form and describe it. **(2 times)**

Ans: A voltage that is applied across x plates is usually provided by a circuit that is built-in CRO and is called sweep or time base generator. Its output waveform is a saw tooth voltage of period T.

37. Define galvanometer and cathode ray oscilloscope. **(2 Times)**

Ans: **Galvanometer:** Galvanometer is a device used to detect the passage of current.

Cathode ray oscilloscope: Cathode ray oscilloscope (CRO) is a high speed graph plotting device.

38. Name the main parts of C.R.O. **(3 Times)**

OR Give name of components of CRO.

Ans: A filament, cathode, grid (together they form election gun), anodes, horizontal deflection plates, vertical deflection plates and a florescent screen.

39. What is Time Base Generator? **(3 Times)**

OR Define sweep voltage.

Ans: **Time Base Generator:** A voltage that is applied across x plates is usually provided by a circuit that is built-in CRO and is called sweep or time base generator. Its output waveform is a saw tooth voltage of period T.

40. What Is cathode ray oscilloscope and write its main parts (4 times)

Ans: Cathode ray oscilloscope Is a high speed graph plotting device. It is called cathode ray oscilloscope because it traces the desired waveform with a beam of electrons which are also called cathode rays.

It is mainly consists of

i. Electron gun
ii. Vertical Deflection plates
iii. Horizontal Deflection plates
Iv. Fluorescent Screen

41. How can you explain the waveform of various voltages formed in CRO?

Ans: We can easily find the instantaneous value and peak value of the voltage with the help of calibration of y-axis in volts.

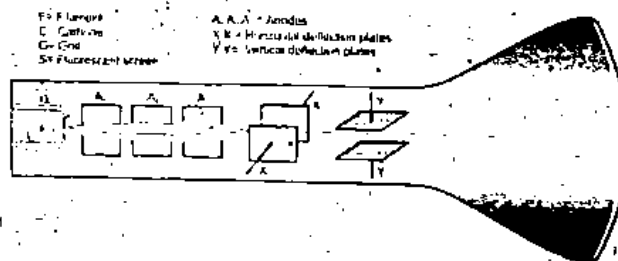
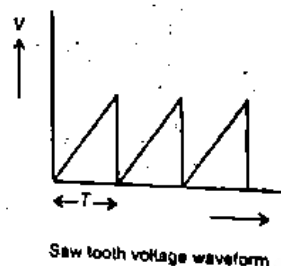
The time period can also be determined by using the time calibration of x-axis. Information about the phase difference between two voltages can be obtained by simultaneously displaying their waveforms.

42. How the beam of electron is focused on the screen of CRO? Show it with diagram.

Ans: CRO works by deflecting beam of electrons as they pass through uniform electric field between the two sets of parallel plates as shown in figure below.

The deflecting beam then falls on a fluorescent screen where it makes a visible spot.

43. Draw saw-tooth voltage wave form and explain it.

Ans:

Saw tooth voltage waveform

44. Explain briefly the working of electron gun in CRO.

Ans: The beam of electrons is provided by electron gun which consists of an indirectly heated cathode, a grid and three anodes. The filament F heats cathode C which emits electrons. The anodes A_1, A_2, A_3 accelerate as well as focus the electronic beam to fixed spot on the screen S. The grid G is at a negative potential with respect to cathode. It controls the number of electrons and thus controls brightness of spot on the screen.

45 What is the function of 'X' and 'Y' plates in C.R.O?

Ans: A voltage applied between the x plates deflects the beam of electron horizontally on the screen i.e. Parallel to x – axis.

A voltage applied between the y – plates deflects the beam vertically on the screen i.e. along y – axis

46 What is CRO? What is the function of Grid in CRO?

Ans: **CRO** stands for cathode ray oscilloscope. It is a high speed graph plotting device. It traces the desired waveform by deflecting beam of electrons as they pass through uniform electric field between the two sets of parallel plates.

Grid controls the number of electrons reaching the screen and thus controls the brightness of spot on the screen.

Topic IX: Torque on a current carrying coil:

47. Is the possible to orient a current loop in a uniform magnetic field such that the loop will not tend to rotate? Explain. (11 Times)

Ans: The torque experienced by a current carrying loop when placed in magnetic field is $\tau = NIBA\cos\alpha$

Clearly when plane of the coil makes and angle of 90^o with magnetic field, thetorque on the coil will be zero. In this condition, the coil will not tend to rotate.

48. What should be the orientation of a current carrying coil in magnetic field so that the torque acting upon the coil is: (a) maximum (b) minimum (2 Times)

Ans: The torque experienced by a current carrying loop when placed in magnetic field is

$$\tau = NIBA\cos\alpha$$

i. When plane of the coil makes and angle of 0^o with magnetic field, the torque on the coil will be maximum. $\tau = NIBA\cos 0^o$

$$\tau = NIBA$$

ii. When plane of the coil makes and angle of 90^o with magnetic field, the torque on the coil will be zero or minimum.

$$\tau = NIBA\cos 90^o$$

$$\tau = 0$$

49. How can a current loop be used to determine the pressure of a magnetic field in a given region of space? (15 Times)

Ans: The torque experienced by a current carrying loop when placed in magnetic field is $\tau = NIBA\cos\alpha$

If the loop is deflected in a given region, then it confirms the presence of magnetic field, otherwise not.

50. What should be the orientation of a current carrying coil in a magnetic field so that torque acting upon the coil is maximum? (2 times)

Ans: The torque experienced by a current carrying loop when placed in magnetic field is

$$\tau = NIBA\cos\alpha$$

When plane of the coil makes an angle of 0^o with magnetic field, the torque on the coil will be maximum.

$$\tau_o = NIBA\cos 0^o$$

$$\tau_o = NIBA$$

51. A loop of wire is suspended between poles of a magnet with its plane parallel to the pole faces. What happens if a direct current is put through the coil? What happens if an alternating current is used instead?

Ans: As the loop of wire is suspended between the poles of a magnet with its plane parallel to the pole faces, so, there will be no effect on the motion of the coil in both cases because the magnetic field becomes perpendicular to the plane of loop.

i.e $\alpha = 90°$

and $\tau = IBA\cos 90° = IBA \times 0 = 0$ $(\because \cos 90° = 0)$

Topic X: Galvanometer:

52. Why the voltmeter should have the very high resistance? (12 times)

Ans: A voltmeter is connected in parallel to the resistor to measure potential difference across it. It should have very high resistance so that practically, a very little current should pass through it and the current of the circuit should almost remain constant, so that it might measure the potential difference across a resistor accurately.

53. What is dead beat galvanometer? (2 times)

Ans: The galvanometer in which the coil comes to rest quickly after current passed through it or the current is stopped from flowing through it, is called stable or a dead beat galvanometer.

54. Why the resistance of an ammeter should be very low? (23 Times)

Ans: An ammeter is connected in series with a circuit to measure the current. It is connected in series so that total current passing through the circuit should pass through it. If the resistance of the ammeter will.be large, it will alter the current of the circuit to great extent and the measurement of current will not be accurate.

55. What is lamp and scale arrangement in galvanometer?

Ans: In sensitive galvanometer, the angle of deflection is observed by means of a small mirror attached to the coil along with the lamp and scale.
A beam of light directed towards the mirror of galvanometer. After reflection, it produces a spot on the screen. The scale provides the small angle of deflection.

56. How can a galvanometer be made more sensitive? **(4 times)**

Ans: Since $I = \frac{c}{BAN}\theta$

A galvanometer can be made more sensitive if $\frac{c}{BAN}$ is made small.

Thus, to increase the sensitivity of galvanometer, c may be decreased or B, A and N may be increased.

57. What is meant by sensitivity of galvanometer? How can a galvanometer be made more sensitive? **(3 times)**

Ans: The degree of deflection of galvanometer by unit current passing through it is referred as its sensitivity. It can be made more sensitive.

Since $$I = \frac{c}{BAN}\theta$$

A galvanometer can be made more sensitive if $\frac{c}{BAN}$ is made small.

Thus, to increase the sensitivity of galvanometer, c may be decreased or B, A and N may be increased.

58. What is current sensitivity of a galvanometer? **(2 Times)**

OR What do you know about sensitivity of galvanometer? **(2 Times)**

Ans: A galvano meter which gives large deflection for the small current is called a sensitive galvanometer.
The degree of deflection of galvanometer by unit current passing through it is referred as its sensitivity. It can be made more sensitive.

Since $$I = \frac{c}{BAN}\theta$$

59. Distinguish between sensitive and dead beat galvanometers.

Ans: A galvanometer which shows large deflection for a small value of unit current is sensitive one whereas a galvanometer in which the coil suddenly comes to rest after the current passes through it or the current is stopped from flowing through it is called dead beat out stable galvanometer.

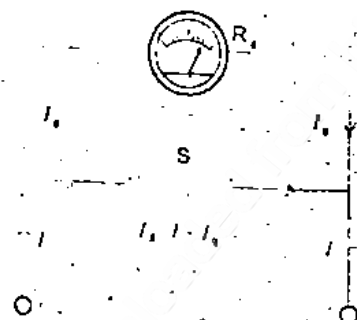
60. Why soft iron cylinder is placed inside the coil of galvanometer?

Ans: The soft iron cylinder makes the magnetic field stronger and radial such that into whatever position the coil rotates, the magnetic field is always parallel to its plane.

61. Define ammeter and volt meter.

Ans: An **ammeter** is an electrical instrument which is used to measure current in amperes.
A **voltmeter** is an electrical device which measures the potential difference in volts between two points.

62. What modification is required to convert a galvanometer into ammeter?

Ans: A shunt is connected in parallel with galvanometer to convert it into ammeter.

63. Define Stable Galvanometer and Ohmmeter.

Ans: A galvanometer in which the coil comes to rest quickly after the current passed through it or the current is stopped from flowing through it, is called **Stable or Dead Beat Galvanometer.**

Ohmmeter is a useful device for rapid measurement of resistance. It measures resistance in ohms.

64 **What is Galvanometer? On which principle it works.**

Ans: A galvanometer is an electrical instrument used to detect the passage of current. Its working principle is:

"A current carrying coil placed in a uniform magnetic field experiences a torque."

65 **How can you prefer potentiometer over voltmeter?**

Ans: Potentiometer can measure and compare potential differences accurately. While a common voltmeter can not do this.

Potentiometer is simple instrument while other accurately measuring devices are very expensive and are difficult to use.

66 **Define Ammeter. How can we increase the range of an ammeter?**

Ans: An ammeter is an electrical instrument which is used to measure current in amperes.

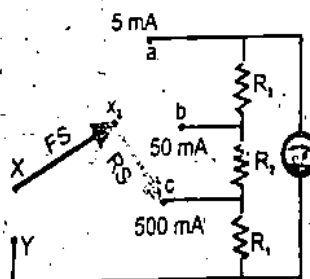
We can increase the range of an ammeter by decreasing the shunt resistance which is connected in parallel with the galvanometer.

Topic XI: Avometer:

67. **Discuss briefly digital multi meter. (DMM)** **(4 times)**

Ans: It is a digital version of an AVO meter. It is used to measure resistance, voltage and current. It has become very popular testing device because the digital values are displayed automatically with decimal point, polarity and the unit for voltage, current and resistance.

These meters are generally easier to use because they eliminate the human error that often occur in reading the dial of an ordinary AVO meter.

68. **Draw a diagram of current measuring part of AVO meter.**

69. **Write the formula used to convert a galvanometer into a voltmeter. Why the resistance of voltmeter should be high?**

Ans: Galvanometer can be converted into ammeter using the relation

$$R_h = \frac{V}{I_g} - R_g$$

A voltmeter is connected in parallel to the resistor to measure potential difference across it. It should have very high resistance so that practically, a very little current should pass through it and the current of the circuit should almost remain constant, so that it might measure the potential difference across a resistor accurately.

70. **What is digital multimeter? Give its two advantages over AVO meter. (3 times)**

Ans: It is a digital version of an AVO meter. It is used to measure resistance, voltage and current.

Advantages:

(i) The digital values are displayed automatically with decimal point, polarity and the unit for voltage, current and resistance.

(ii) These meters are generally easier to use because they eliminate the human error that often occur in reading the dial of an ordinary AVO meter.

71. **What is AVO-meter? Explain.**

Ans: It is an instrument which can measure current in amperes, potential difference in volts and resistance in ohms. It basically consists of a sensitive moving coil galvanometer which is converted into multi range ammeter, voltmeter or ohmmeter accordingly as a circuit.

2021

72. The magnetic field in a certain region is given by $\vec{B} = (40\hat{i} - 18\hat{k})Wbm^{-2}$. How much flux passes through a $5.0cm^2$ area loop in this region if the loop lies flat in the xy-plane?

Given that

Magnetic induction = $\vec{B} = (40\hat{i} - 18\hat{k})Wbm^{-2}$

Area of loop = $A = 5.0cm^2$

$= A = 5.0\times10^{-4}m^2\hat{k}$

Magnetic flux = $\phi_B = ?$

By formula

$$\phi_B = \vec{B}.\vec{A}$$

$$= (40\hat{i} - 18\hat{k}).(5.0\times10^{-4}\hat{k})$$

$$= 90\times10^{-4}Wb$$

Magnetic flux = $\phi_B = 90\times10^{-4}Wb$

73. Prove that $\vec{F} = q\vec{E} + q(\vec{v}\times\vec{B})$.

Ans: When an electric charge q is placed in an electric field $\vec{E}$, it experiences a force $\vec{F}$ parallel to electric field. It is given by

$$\vec{F} = q\vec{E}$$

If the charge is free to move, then it will accelerate according to Newton's second as

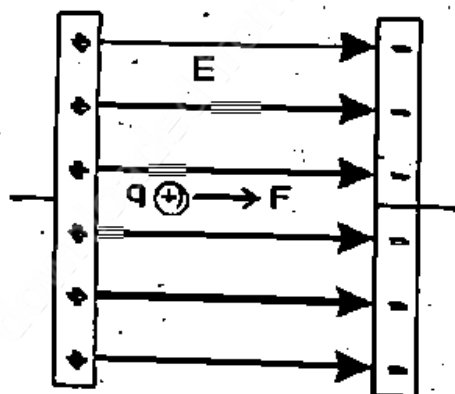
$$a = \frac{\vec{F}}{m} = \frac{q\vec{E}}{m} \quad ....(i)$$

If electric field is uniform, then acceleration is also uniform and hence, the position of the particle at any instant of time can be found by using equations of uniformly accelerated motion.

When a charge particle q is moving with velocity $\vec{v}$ in a region where there is an electric field $\vec{E}$ and magnetic field $\vec{B}$, the total force $\vec{F}$ is the vector sum of the electric force $q\vec{E}$ and magnetic force $q(\vec{E}\times\vec{B})$ that is,

$$\vec{F} = \vec{F}_e + \vec{F}_b$$

$$\vec{F} = q\vec{E} + q(\vec{v}\times\vec{B}) \quad ....(ii)$$

This force F is known as the Lorentz force.

74. Discuss the extension of right-hand rule to find the direction of magnetic force on a current carrying conduct. OR Explain the principle of extension of right-hand rule.

Ans: The direction $\vec{F}$ is also given by right hand rule of cross product of $\vec{L}$ and $\vec{B}$, i.e,, rotate $\vec{L}$ towards $\vec{B}$ through the smaller angle. Curl the fingers of right hand in the direction of rotation, the thumb points in the direction of force.

Direction of $\vec{F}$ can also be determined by right hand palm rule and Fleming's left hand rule.

75. What is working principle of "CRO"?

Ans: Its works by deflecting the beam of electrons as they pass through uniform electric field between the two sets of parallel plates. The deflected beam then falls on fluorescent screen where it makes a visible spot. It can display the graphs of functions which rapidly vary with time.

76. How does the graph pattern appear stationary on the screen of CRO? Explain the condition.

Ans: The pattern will appear stationary only if the time T is equal to or is some multiple of the time of one cycle of the voltage on y plates. It is thus necessary to synchronize the frequency of the time base generator with the frequency of the voltage at the y plates. This is possible by adjusting the synchronization controls provided on the front panel of the CRO.

77. Describe the right-hand rule to direction of magnetic field inside a current carrying solenoid.

Ans: The direction of magnetic field strength B finds out by right hand rule which states:
"Hold the solenoid in the right hand with figures curling in the direction of, current, the thumb will point in the direction of the field".

78. Electric force does work, while no work is done by the magnetic force. Why?

Ans: The magnetic force on the charged particle moving in a magnetic field is given by

$$\vec{F_m} = q(\vec{V} \times \vec{B})$$

Due to the magnetic force, the charge particle will moves in a circular path. In circular path , the force $\vec{F_m}$ is perpendicular to the velocity $\vec{V}$. Hence magnetic force has done no work, i.e,

$$W = \vec{F}.\vec{d}$$

$$W = Fd\cos\theta$$

But $\theta = 90^o$ (The angle between $\vec{F}$ and $\vec{V}$ is 90^o)

So, $W = Fd\cos 90^o$

$$W = 0$$

So there is no work done by the magnetic force. This means that magnetic force is only a deflecting force.

79. Describe the change in the magnetic field inside a solenoid carrying a steady current I, if (a) the length of the solenoid is doubled but the numer of turns remains the same and (b) the number of turns is doubled, but the length remains the same.

Ans: We know that the expression for the magnetic field produced by a solenoid is given by

$$B = \mu_o nI$$

But $n = \frac{N}{L}$

$$B = \mu \frac{NI}{L} \quad ....(i)$$

(a) Let B be the magnetic field when the length of the solenoid is doubled i.e, $L' = 2L$ and the number of turns, remains same.

Then $B' = \frac{\mu_o NI}{2L}$

$$B' = \frac{1}{2} \times \frac{\mu_o NI}{L}$$

i.e $B' = \frac{\mu_o NI}{L}$

$$B' = \frac{1}{2} \times B$$

Then $B' = \frac{B}{2}$

Hence the magnetic field becomes half if the length of solenoid becomes double but the number of turns remain, same.

(b) Let B' be the magnetic field when the number of turns is doubled i.e $N' = 2N$ and the length remaisn same.

Then $B' = \frac{\mu_o (2N) I}{L}$

$$B' = 2\frac{\mu_o NI}{L}$$

Since $\frac{\mu_o NI}{L} = B$

$$\Rightarrow B' = 2B$$

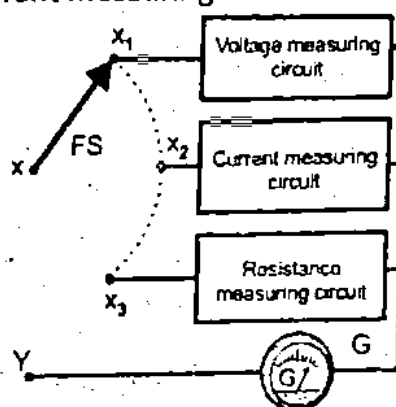
Hence the magnetic field becomes double if the number of turns of the solenoid becomes doubled but length remains same.

80. Describe the function of two sets of deflecting plates in cathode ray, oscilloscope.

Ans: The voltage that is provided across horizontal plates is usually provided by a circuit that is built in the CRO. It is known as sweep or time base generator whose output waveform is a saw tooth voltage of period T. If a sinusoidal voltage is applied across the y plates when, simultaneously, time base voltage is impressed across horizontal plates, will now spread out and appear as sinusoidal trace on the screen.

81. In an AVO meter, how can a single galvanometer perform the function of measuring current, voltage and resistance? Explain.

Ans: It is an instrument which can measure current in amperes, potential difference in volts and resistance in ohms. It is basically consists of a sensitive moving coil galvanometer which is converted into a multi range ammeter, voltmeter or ohmmeter accordingly as a current measuring circuit or a voltage measuring circuit or a resistance measuring circuit is connected with the galvanometer with

the help of a switch known as function switch (Figure): Here X, Y are the main terminals of the AVO meter which are connected with the circuit in which measurement is required. FS is the function selector switch which connects the galvanometer with relevant measuring circuit.

LONG QUESTIONS OF CHAPTER-14 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Magnetic Field due to current in a straight long wire:

1. Derive expressions of force on a current carrying conductor placed in a uniform magnetic field? **(4 Times)**

Topic II: Force on a current carrying conductor in a uniform magnetic field:

2. Derive an expression for force acting on a current carrying conductor of length L placed in a uniform magnetic filed of strength B.

Topic IV: Ampere's Law:

3. Define Ampere's law. Calculate the magnetic field due to current flowing through a solenoid. **(4 times)**
4. State Amphere's law and apply it to find the felid due to a current carrying solenoid. **(9 Times)**

Topic V: Force on a moving charge in a uniform magnetic field:

5. Find the force on moving charge in magnetic field.
6. A moving charge enters a uniform magnetic field. Derive a relation for magnetic force on that charge.
7. Derive expression for force on a moving charge in magnetic field? **(4 Times)**
8. Define magnetic field. Find the value of force on a moving positive charge in a magnetic field. **(2 Times)**

Topic VII: Determination of e/m value of an electron:

9. Define Lorentz force. Determine the e/m of an electron. **(2 Times)**
10. Explain how e/m (charge to mass ratio) for an electron is determined? **(4 Times)**
11. How can you find the relation of e/m of an electron?

Topic VIII: Cathode Ray Oscilloscope:

12. What is cathode ray oscilloscope? Explain the functions of: **(2 Times)**
    (i) Cathode (ii) Grid (iii) Anodes (iv) Deflecting plates (v)Sweep generator

Topic IX: Torque on a current carrying coil:

13. Establish a relation for the torque experienced by a current carrying rectangular coil in a uniform magnetic field. **(2 Times)**
14. Derive the expression for torque on current carrying coil in uniform magnetic field. **(3 Times)**

Topic X: Galvanometer:

15. What is galvanometer? Describe its principle, construction and working.
16. How can we convert the galvanometer into voltmeter and ammeter? **(2 Times)**
17. What is galvanometer? How can it be converted into : (a). Ammeter. (b). Voltmeter

Numerical Problems OF CHAPTER-14 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Magnetic Field due to current in a straight long wire:

1. A power line 10 m high carries a current 200 A. Find the magnetic field of the wire at the ground? (15 Times)

Ans: Given that height of power line = h= $r = 10\ m$

$$I = 200\ A$$
$$B = ?$$

Using Ampere's law $B(2\pi r) = \mu_0 I$

$$B = \frac{\mu_0 I}{2\pi r}$$
$$B = \frac{4\pi \times 10^{-7} \times 200}{2\pi \times 10}$$
$$B = 40\times 10^{-7}\ T$$
$$B = 4 \times 10^{-6}\ T$$
$$\boxed{B = 4\ \mu T}$$

Topic IV: Ampere's Law:

2. What current should pass through a solenoid that is 50 cm long with 10000turns of copper wire so that it will have a magnetic field of 0.4 T? (7 Times)

Ans: Given that $L = 50\ cm = 0.5\ m$

$$N = 10000$$
$$B = 0.4\ T$$
$$\mu_o = 4\pi \times 10^{-7}\ Wb/Am$$
$$I = ?$$

Since $B = \mu_0 n I$

$$I = \frac{B}{\mu_0 n}$$

Here, $n = \frac{N}{L} = \frac{10000}{0.5} = 20000\ turns/m.$

Putting the values, we get

$$I = \frac{0.4}{4\pi \times 10^{-7} \times 20000}$$
$$I = 15.92\ A$$
$$\boxed{I \cong 16\ A}$$

3. A solenoid 15 cm long has 300 $turns$ of wire. A current of 5 $ampere$ flows through it. What is the magnitude of magnetic field inside the solenoid? (3 times)

Ans: Given that $length\ of\ the\ solenoid = l = 15\ cm = 0.15\ m$

$$number\ of\ turns = N = 300\ turns$$
$$current = I = 5\ A$$
$$number\ of\ turns\ per\ unit\ length = n = \frac{N}{l} = \frac{300}{0.15}$$
$$n = 2000\ ^{turns}/_{m}$$
$$magnetic\ field = B = ?$$

Since

$$B = \mu_0 n I$$
$$B = 4\pi \times 10^{-7} \times 2000 \times 5$$
$$\boxed{B = 1.3 \times 10^{-2}\ Wbm^{-2}}$$

Topic VI: Motion of charge particle in electric and magnetic field:

4. How fast must a proton move in magnetic field of $2.50 \times 10^{-3}\ T$ such that the magnetic force is equal to its weight? (7 Times)

Ans: Given that $mass\ of\ proton = m_P = 1.67 \times 10^{-27}\ kg$

$$charge\ on\ proton = q = 1.6 \times 10^{-19}\ C$$
$$magnetic\ field = B = 2.50 \times 10^{-3}\ T$$
$$velocity\ of\ proton = v = ?$$

According to given condition

Magnetic force = weight

$$F_B = W$$
$$qvB = mg$$
$$v = \frac{mg}{qB}$$
$$v = \frac{1.67 \times 10^{-27} \times 9.8}{1.6 \times 10^{-19} \times 2.50 \times 10^{-3}}$$
$$\boxed{v = 4.09 \times 10^{-5}\ ms^{-1}}$$

5. Find the radius of an orbit of an electron moving at a rate of $2.0 \times 10^{7}\ ms^{-1}$ in a uniform magnetic field of $1.2 \times 10^{-3}\ T$. (3 times)

Ans: Given that $v = 2.0 \times 10^{7}\ ms^{-1}$

$$B = 1.2 \times 10^{-3}\ T$$
$$m = 9.1 \times 10^{-31}\ kg$$
$$e = 1.6 \times 10^{-19}\ C$$
$$r = ?$$

Since $r = \frac{mv}{eB}$

$$r = \frac{9.1 \times 10^{-31} \times 2.0 \times 10^{7}}{1.6 \times 10^{-19} \times 1.2 \times 10^{-3}}$$
$$\boxed{r = 9.43 \times 10^{-2}\ m}$$

6. Alpha particles ranging in speed from $1000\ ms^{-1}$ to $2000\ ms^{-1}$ enter a velocity select where electric intensity is $300\ Vm^{-1}$ and the magnetic induction is $0.20\ T$. Which particle will move undeviated through the field? (3 Times)

Ans: Given that $E = 300\ Vm^{-1} = 300\ NC^{-1}$

$$B = 0.20\ T$$

Here only those particles will move undeviated through the field for which

$$F_e = F_B$$
$$qE = qvB$$
$$E = vB$$
$$v = \frac{E}{B}$$
$$v = \frac{300}{0.20}$$
$$\boxed{v = 1500\ ms^{-1}}$$

The alpha particles having a speed of $1500\ ms^{-1}$ will move undeviated through the field.

Topic IX: Torque on a current carrying coil:

7. **A coil of $0.1\,m \times 0.1\,m$ and of $200\ turns$ carrying a current of $1\,mA$ is placed in a uniform magnetic field of $0.1\,T$. Calculate the maximum torque that acts on the oil.** **(3 times)**

Ans: Given that $area\ of\ coil = A = 0.1\,m \times 0.1\,m = 0.01\,m^2$

$$number\ of\ turns = N = 200$$
$$current = I = 1\,mA = 1 \times 10^{-3}\,A$$
$$magnetic\ field = B = 0.1\,T$$
$$maximum\ torque = \tau_{max} = ?$$

Since $\tau = NIAB\cos\alpha$

For maximum torque $\alpha = 0^o$

So $\tau_{max} = NIAB\cos 0^o$

$$\tau_{max} = NIAB$$
$$\tau_{max} = 200 \times 1 \times 10^{-3} \times 0.01 \times 0.1$$
$$\boxed{\tau_{max} = 2 \times 10^{-4}\,Nm}$$

Topic X: Galvanometer:

8. **What shunt resistance must be connected across a galvanometer of $50.0\,\Omega$ resistance which gives full scale deflection with $2.0\,mA$ current, so as to convert it into an ammeter of range $10.0\,A$?** **(3 times)**

Ans: Given that $R_g = 50.0\,\Omega$

$$I_g = 2.0\,mA = 2 \times 10^{-3}\,A$$
$$I = 10.0\,A$$
$$R_s = ?$$

Since $R_s = \frac{I_g}{I - I_g} R_g$

$$R_s = \frac{2 \times 10^{-3}}{10 - 2 \times 10^{-3}} 50$$
$$\boxed{R_s = 0.01\,\Omega}$$

9. **The resistance of galvanometer is 50 Ohm and reads full deflection with a current of 2.0 mA. Show by diagram how to convert this galvanometer into voltmeter reading 200 volt full scale.**

Ans: Given that

$$R_g = 50.0\,\Omega$$
$$I_g = 2.0\,mA = 2 \times 10^{-3}\,A$$
$$V = 200\,V$$
$$R_h = ?$$

Since for converting galvanometer into voltmeter expression is,

$$R_h = \frac{V}{I_g} - R_g$$

Putting the values we get,

$$R_h = \frac{200}{2 \times 10^{-3}} - 50$$

$$R_h = 100 \times 10^3 - 50$$

$$= 99950\ \Omega$$

10. **A galvanometer having an internal resistance $R_g = 15.0\Omega$ gives full scale deflection with current $I_g = 20.0mA$. It is to be converted into an ammeter of range 10.0 A. Find the value of shunt resistance R_s.**

Sol:

$R_g = 15.0\Omega$

$I_g = 20.0mA = 20 \times 10^{-3} A$

$I = 10.0A$

$R_s = ?$

as $R_s = \frac{I_g R_g}{I - I_g}$

$$R_s = \frac{20 \times 10^{-3} \times 15.0}{10.0 - 20 \times 10^{-3}}$$

$$R_s = \frac{0.3}{9.98}$$

$$R_s = 0.03\Omega$$

2021

11. **Find the radius of an orbit of an electron moving at a rate of $2.0 \times 10^7 ms^{-1}$ in a uniform magnetic field of 1.20×10^{-3} T.**

Given that

Speed of electron $= v = 2.0 \times 10^7 ms^{-1}$

Magnetic field strength $= B = 1.20 \times 10^{-3} T$

Mass of electron $= m = 9.11 \times 10^{-31} kg$

Charge on electron $= e = 1.6 \times 10^{-19} C$

Radius of the orbit $= r = ?$

By formula

$$r = \frac{mv}{eB}$$

$$r = \frac{9.11 \times 10^{-31} \times 2.0 \times 10^7}{1.6 \times 10^{-19} \times 1.20 \times 10^{-3}}$$

$$r = 9.43 \times 10^{-2} m$$

OBJECTIVES (MCQ'S) OF CHAPTER-15 IN ALL PUNJAB BOARD 2011-2021

Topic I: Induce emf and Induce current:

1. When a conductor moves across a magnetic field, an emf is set up, this emf is called:
(A) Length of conductor (B) Speed of conductor
(C) Strength of magnet (D) All of these
2. A metal rod of 1 m is moving at a speed of $1ms^{-1}$ in a direction making an angle 30° with 0.5 T magnetic field. The emf produced is:
(A) 0.25 N (B) 2.5 N (C) 0.25 V (D) 2.5 V

Topic II: Motional emf:

3. The motional emf is given by:
(A) qvB (B) iBL (C) eBL (D) vBL
4. The rod of unit length is moving at 30° through a magnetic field of 1 T. If velocity of rod is 1 m/s , then induced emf in the rod will be given by:
(A) 1 V (B) 0.2 V (C) 0.5 V (D) 0.6 V
5. $\frac{B^2}{2\mu_o}$ is the expression of:
(a) Lenz's law (b) magnetic energy (c) Magnetic energy density (d) back emf
6. The motional emf depends upon the:
(A) Variable emf (B) Constant emf (C) Induced emf (D) Back emf

Topic III: Farad Law:

7. The maximum value of emf induced in armature of N turns and area A rotating in magnetic field B with frequency "f" is given by:
(A) $2\pi fNAB$ (B) $2\pi fN^2AB$ (C) NfAB (D) $4\pi f^2NAB$
8. Energy stored per unit volume inside a solenoid is called:
(A) Electric flux (B) Energy density (C) Work (D) Volume charge density
9. The 'emf' always ____ even when no current is drawn through the battery of cell
(A) Zero (B) Present (C) Absent (D) Maximum
10. The SI unit if induced emf is:
(A) Ohm (B) Tesla (C) Henry (D) Volt
11. A rod of length 20 m is moving with 20 m/s in a direction perpendicular to magnetic field of 20 T what is the value of emf:
(A) 2000V (B) 4000V (C) 6000V (D) 8000V
12. The ratio of average induced emf to the rate of change of current in the coil is called:
(A) Self-inductance (B) Mutual inductance (C) Self-induction (D) Mutual induction
13. The relation $\varepsilon = -N\frac{\Delta\phi}{\Delta t}$ is known as:
(A) Ampere's law (B) Faraday's law (C) Lenz's law (D) Kickoff's law
14. The negative sign with induced emf in Faraday's law is in accordance with:
(A) Lenz's law (B) Ampere's law (C) Gauss's law (D) Boyle's law
15. The product of induced current and resistance of the wire through which the current is passing is called:
(A) Mutual induction (B) Self-induction (C) Induced current (D) Induced emf
16. If we make magnetic field stronger the value of induced current: (2 times)
(A) Decrease (B) Increase (C) Vanishes (D) Remains constant
17. Emf is induced due to change in: (2 times)
(A) Charge (B) Current (C) Magnetic flux (D) Electric field
18. A changing electric flux creates:
(A) Electric field (B) gravitational field (C) Magnetic field (D) electric charge
19. Electromagnetic induction obeys Law of Conservation of:
(A) Charge (B) Energy (C) Momentum (D) Mass

Topic IV: Lenz's Law:

20. Lenz's law is a consequence of the law of conversation of: (6 Times)
(A) Charge (B) Current (C) Energy (D) Momentum

21. Lenz's law deals with: (5 times)
(a) Magnitude of emf (b) direction of emf
(c) Direction of induced current (d) resistance

22. Lenz's law is in accordance with the law of conservation of: (3 times)
(A) Momentum (B) Angular momentum (C) Charge (D) Energy

Topic V: Mutual Induction:

23. The magnetic force acting on a unit +ve charge moving at right angle to the magnetic field with unit velocity is called:
(A) Magnetic flux (B) Induced emf (C) Motional emf (D) Magnetic induction

24. The notation for Henry is: (10 Times)
(A) $V.S^{-1}A$ (B) $N.m.A^{-1}$ (C) $V^{-1}.S.A$ (D) $V.S.A^{-1}$

25. One of the practical applications of mutual inductance is: (5 times)
(A) Step-down transformer (B) Operational amplifier
(C) Rectifier (D) Choke

26. Henry is SI unit of: (4 Times)
(A) Current (B) Resistance (C) Flux (D) Self induction

27. Mutual induction between two coils depends upon their:
(A) Size (B) Shape
(C) Separation (D) Size, shape, separation and orientation

28. The mutual induction between two coils depends upon:
(A) Area of coils (B) Number of turns of the coils
(C) Distance between the coils (D) All of these

29. Inductance of the coil can be increased by using:
(A) Paramagnetic core (B) Diamagnetic core
(C) Ferromagnetic core (D) Antiferromagnetic core

30. Mutual Induction has a practical role in the performance of the: (2 Times)
(A) Radio Choke (B) Transformer (C) A.C Generator (D) D.C Generator

31. The mutual Inductance between two coils depends upon their:
(A) Size (B) Core material
(C) Separation (D) Size, Core material and Separation

Topic VI: Self-Induction:

32. Self inductance does not depend upon:
(A) Number of turns of the coil (B) Area of cross-section of the core
(C) Nature of material of the core (D) Current though inductor

33. Self-induced emf is sometimes called as: (2 times)
(A) Motional emf (B) Constant emf (C) Back emf (D) Variable emf

34. The self-inductance of solenoid is:- (3 Times)
(a) $L=\mu_0 nAl$ (b) $L=\mu_0 N^2 Al$ (c) $L=\mu_0 n^2 Al$ (d) $L=\mu_0 NAl$

35. The S.I unit of self-inductance or mutual inductance is: (2 Times)
(A) Maxwell (B) Weber (C) Henry (D) Tesla

Topic VII: Energy Stored in an Inductor:

36. Energy stored in the indicator is: (7 Times)
(A) $\frac{1}{2}L^2I$ (B) $\frac{1}{2}LI$ (C) $\frac{1}{2}LI^2$ (D) $\frac{1}{2}L^2I^2$

37. Formula for energy density for an inductor is: (3 Times)
(A) $\frac{B^2}{2\mu_o}$ (B) $\frac{1}{2}\varepsilon_0 E^2$ (C) $\frac{1}{2}CV^2$ (D) $\frac{1}{2}LI^2$

38. If an inductor has N turns of a coil and ϕ is magnetic flux through its each turn when current I is following, then its self-inductance is given by L: (2 Times)
(A) $\frac{I}{N\phi}$ (B) $\frac{N\phi}{I}$ (C) $\frac{NI}{\phi}$ (D) $\frac{\phi}{NI}$

39. An inductor may store energy in: (3 Times)
(A) Its magnetic field (B) Its electric field (C) Its coil (D) A neighboring circuit

40. **Energy density is an inductor is:**
(A) Directly proportional to magnetic field
(B) Directly proportional to square of magnetic field
(C) Inversely proportional to magnetic field
(D) Inversely proportional to square of magnetic field

Topic VIII: Alternating Current Generator:

41. **The devices in the circuit that consume electrical energy are known as:**
(a) Dissipaters (b) generators (c) load (d) motors
42. **Which one is not present in A.C generator?** **(2 times)**
(a) Armature (b) Magnet (c) Slip rings (d) Commutator
43. **The emf produced by an alternating current generator is:**
(A) NwAB sin θ (B) NwAB cos θ (C) NwAB sin2 θ (D) NwAB cos2 θ
44. **Induced emf in A.C. generator can be increased by**
(A) Decreasing area of coil (B) Decreasing magnetic field
(C) Increasing area of coil (D) Slowing down speed of coil

Topic IX: D.C Generator:

45. **An electric generator is based on the principle of:** **(2 times)**
(A) Faraday's law (B) Lenz's law (C) Ampere's law (D) Gauss's law
46. **A generator converts mechanical energy into:**
(A) Chemical energy (B) Light energy (C) Heat energy (D) Electrical energy
47. **When current flows through the armature coil then the torque produced depends upon:**
(A) Rotation of the coil (B) Area of the coil (C) Mutual induction (D) All of the above
48. **The principle of alternating current generator is based on:**
(A) Coulomb's law (B) Ampere's law (C) Lenz's law (D) Faraday's law
49. **If the speed of rotation of a generator is doubled the output voltage will be:**
(A) Remain Same (B) Double (C) Four Time (D) One Half
50. **Basic circuit element in a D.C circuit which controls the current and voltage is:**
(A) Capacitor (B) resistor (C) inductor (D) transistor
51. **In D.C generator, split rings act as:**
(A) Capacitor (B) Commutator (C) Inductor (D) Resistor

Topic X: D.C Motor:

52. **When back emf is zero, it draws:** **(2 Times)**
(A) Zero current (B) Minimum current (C) Maximum current (D) Steady current
53. **The jerks in D.C motors are created by the use of:**
(A) Commutator (B) Armature (C) Torque (D) Source of emf
54. **When the back emf in the motor is maximum, it draws:**
(A) Maximum current (B) Steady current (C) Zero current (D) minimum current
55. **A device which converts electrical energy into mechanical energy:** **(2 times)**
(A) Transformer (B) A.C generator (C) D.C motor (D) D.C generator
56. **When a motor is just started, back emf is almost ______:** **(3 Times)**
(A) Maximum (B) Zero (C) Minimum (D) Infinite
57. **In D.C circuits, current and voltage are controlled by:**
(A) Capacitor (B) Inductor (C) Resistor (D) Gate
58. **If the motor is over loaded then magnitude of back emf:** **(4 Times)**
(A) Increases (B) decreases (C) Zero (D) remains constant
59. **The winding of the electromagnet in motor are usually called:**
(a) Magnetic coils (b) Field coils (c) Electric coils (d) Electric-o-electric coils
60. **The Jerks in D.C. motor are created by the use of**
(A) Armature (B) Commutators (C) Slip rings (D) Source of emf
61. **With the increase in speed of motor, the magnitude of back emf:**
(A) Remains same (B) Increases
(C) Decreases (D) First increases then decreases
62. **Out put of D.C motor is:**
(A) A.C energy (B) Mechanical energy (C) Chemical energy (D) D.C energy

Topic XI: Transfarmer:

63. **A step-up transformer has primary voltage of 50V D.C. The secondary voltage is:**
(A) 20V (B) 40V (C) Zero (D) 220V

64. An Ideal transformer obeys the law of conversation of:
(A) Flux (B) Momentum (C) emf (D) Energy
65. The turn ratio of a step up transformer is 50, the voltage ratio and current ratio will be:
(A) 50, 50 (B) 50, 0.02 (C) 0.02, 50 (D) 0.02, 0.02
66. The power loss in transformer takes place due to:
(A) Eddy current (B) Magnetic field (C) Hysteresis (D) A and C only
67. Turns ratio of a transformer is 50. If 220V AC is applied to its primary coil, voltage in the secondary coil will be:
(A) 44V (B) 4.4V (C) 220V (D) 11000V
68. To construct a step down transformer:
(A) $N_s < N_p$ (B) $N_s > N_p$ (C) $N_s = N_p$ (D) $N_s.N_p = 1$
69. When constant current flows in primary of transformer then emf Induced across secondary of transformer is:
(A) Zero (B) Constant (C) Alternating (D) Irregular
70. In a transformer which of the following quantities has same value in primary and secondary:
(A) Rate of change of magnetic flux (B) Voltage
(C) Current (D) None of these
71. A transformer:
(A) Transforms power (B) Generates emf (C) Transforms voltage (D)Transforms energy
72. To construct a step down transformer: **(2 times)**
(A) $N_s < N_p$ (B) $N_s > N_p$ (C) $N_s = N_p$ (D) $N_s.N_p = 1$
73. Efficiency of transformer is not effected by:
(A) Input voltage (B) core of transformer
(C) Insulation between sheets (D) Resistance of coils
74. Eddy currents are one caused of energy loss in:
(A) A.C generator (B) Transformer (C) D.C motor (D) D.C generator
75. Transformer is used to change: **(2 Times)**
(a) Electric power (b) magnetic power
(c) Alternating voltage (d) phase of A.C
76. A step up transformer is used 120 v line to provide 240 v. If primary coil has 100 turns, the number of turns in secondary coil is:
(a) 50 (b) 100 (c) 150 (d) 200
77. Transformer work on principle of: **(2 times)**
(A) Mutual induction (B) Self induction
(C) Electrostatic Induction (D) Both mutual and self induction
78. The condition for a step – down transformer is:
(A) $N_s > N_p$ (B) $V_s > V_p$
(C) $I_s > I_p$ (D) output power greater than input power
79. If D.C in inupt for a step – up transformer, then its output is:
(A) Zero (B) High (C) Low (D) May be high or low

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80. If a step-up transformer were 100% efficient, the primary and secondary windings would have the same:
(a) Current (b) length (c) momentum (d) plank constant
81. The mutual inductance of the coils depends upon: **(2 Times)**
(a) density of coil (b) material of coil (c) geometry of coil (d) stiffness of coil
82. A 50 mH coil carries a current of 2.0 A. then energy stored in its magnetic field is:
(a) 0.1 J (b) 10 J (c) 100 J (d) 1000 J
83. In non-ideal step-up transformer which quantity remains unchanged:
(A) power (B) frequency (C) current (D) voltage
84. Lenz's law is in accordance with the law of conservation of:
(A) Momentum (B) Angular Momentum (C) Charge (D) Energy
85. Which of the following converts electrical energy into mechanical energy:
(A) Transformer (B) Motor (C) D.C. generator (D) A.C. generator

86. The only difference between the construction of DC and AC generator is:
(A) Carbon brushes (B) coil (C) Commutator (D) Magnetic field

87. If the coil is wound on iron core, the flux through it: (2 times)
(A) Decreases (B) Becomes zero (C) Increases (D) Remains constant

88. The expression for energy density of solenoid is given as:
(A) $\frac{B^2}{\mu_0}$ (B) $2\frac{B^2}{\mu_0}$ (C) $\frac{1}{2}\frac{B^2}{\mu_0}$ (D) $B^2\mu_0$

89. A simple device that prevents the direction of current from changing is called:
(A) Commutator (B) Rotor (C) Armature (D) Detector

90. In A.C inductor behaves as:
(A) Capacitor (B) Resistor (C) Cummulators (D) Transistor

91. In A.C generator when plane of coil is perpendicular to the magnetic field, then output of generator is:
(A) NWAB (B) 2πf (C) maximum (D) zero

92. If a step-up transformer were 100% efficient, the primary and secondary windings would have the same:
(A) Current (B) Power (C) Voltage (D) Direction of winding

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93. Commutators are used in.
(A) D.C. generators (B) A.C generators (C) A.C. motor (D) A.C. rotator

94. When the motor is running at maximum speed, the back emf will be:
(A) Maximum (B) Minimum (C) No back emf (D) Varies

95. Energy stored in the inductor is in the form of:
(A) electrical energy (B) Magnetic energy (C) Kinetic energy (D) Chemical energy

96. A transformer steps 220 V to 40 V, If the secondary turns are 40 and then primary turns are:
(A) 20 (B) 40 (C) 120 (D) 220

97. The loss of energy over each A.C. cycle magnetization and demagnetization of transformer core is due to:
(A) Electric current (B) Electronic current (C) Eddy current (D) Conventional current

98. When current flowing through an inductor is doubled, then energy stored in it becomes:
(A) half (B) four times (C) one fourth (D) doubled

99. If a conductor of length 1m is moved with Velocity V across a magnetic field B at an angle 30° with B, then the Motional emf will be:
(A) vBL (B) $\frac{1}{2}$vBL (C) $\frac{1}{2}$vB (D) 0.866 vB

100. If the Angular Frequency of A.C. Generator increased to double, the time period would become:
(A) Double (B) 4 Times (C) $\frac{1}{4}$ Times (D) Half

101. During each cycle of A.C. Voltage reaches a peak value:
(A) Once (B) Twice (C) Thrice (D) Four Times

102. Transformer is an Electrical Device used change:
(A) Alternating Current (B) Direct current (C) Alternating emf (D) Voltage

103. The Lenz's Law is also a statement of: (2 Times)
(A) Law of Conservation of Momentum (B) Law of Conservation of Charge
(C) Law of Conservation of Energy (D) Faraday Law of Electromagnetic Induction

104. Electric current produces magnetic field was discovered by:
(A) Faraday (B) Maxwell (C) Oersted (D) Lenz

105. One of the applications of mutual induction is:
(A) Choke (B) Rectifier (C) Rheostat (D) Step up transfer

106. To construct a step up transformer:
(A) $N_s > N_p$ (B) $N_s < N_p$ (C) $N_s = N_p$ (D) $N_s N_p = 1$

107. Maximum emf generated in a generator is:
(A) $\varepsilon_o = \varepsilon \sin\theta$ (B) $\varepsilon = \varepsilon_o \sin\theta$ (C) $\varepsilon_o = N\omega AB \sin\theta$ (D) $\varepsilon_o = N\omega AB$

108. For an ideal step up transformer:
(A) $N_p > N_s$ (B) $N_s I_s > V_p I_p$ (C) $V_s < V_p$ (D) $I_s < I_p$

2021

109. If 10 A current passes through 100 mH inductor, then energy stored is:
(A) 100 J (B) 5 J (C) 20 J (D) Zero

110. The core of the transformer is laminated to reduce:
(A) Magnetic loss (B) Electric loss (C) Eddy current loss (D) Hysteresis loss

111. Lenz's law is in accordance with the law of conservation of:
(A) Mass (B) Momentum (C) Energy (D) Charge

112. Assembly of Coil and Cylinder is called :
(A) Generator (B) Solenoid (C) Router (D) Armature

113. The direction of induced current is always so as to oppose the change which causes the current is:
(A) Faraday's Law (B) Lenz's law (C) Ohm's Law (D) Kirchhoff's 1st rule

114. The Lenz's law is also a statement of law of conservation of
(A) Charge (B) Parity (C) Mass (D) Energy

115. The principle of A.C generator is
(A) Lenz's law (B) Faraday's law (C) Mutual induction (D) Coulomb's law

116. A device which converts mechanical energy into electrical energy is called:
(A) D.C generator (B) D.C motor (C) A.C generator (D) transformer

117. The relation for self-inductance of the solenoid is:
(A) $L = \mu_o nAl$ (B) $L = \mu_o NAl$ (C) $L = \mu_o n^2 Al$ (D) $L = \mu_o N^2 Al$

118. The self-induced emf is sometimes called ________ emf.
(A) motional (B) constant (C) back (D) variable

119. The principle of A.C generator is:
(A) Mutual induction (B) Self induction
(C) Electromagnetic induction (D) All of these

120. Mutual inductance of two coils does not depend on:
(A) Number of turns of the coils (B) Area of cross-section of coils
(C) Density of material of coils (D) Nature of the core material

121. If the magnetic field intensity is doubled then magnetic energy density becomes:
(A) Four times (B) Double (C) Half (D) Eight times

122. The induced emf primarily produced at the cost of:
(A) Internal energy (B) Chemical energy
(C) Electrical energy (D) Mechanical energy

123. The current flowing through a coil due to induced emf in it depends upon:
(A) Shape of the coil (B) Resistance of the coil
(C) Area of the coil (D) Magnetic flux

124. The emf induced in 1 mH inductance in which current changes from 5A to 3A in 1ms is:
(A) $2\times10^{-6}V$ (B) $8\times10^{-6}V$ (C) 2 V (D) 8 V

125. The inductance of Coil is proportional to:
(A) Its shape (B) The number of turns
(C) The Resistance of Coil (D) The Square of the number of turns

126. The current in a coil changes from 0 to 2 A in 0.05 s. If the induced emf is 80 V, the self inductance of the coil is:
(A) 1 H (B) 0.5 H (C) 1.5 H (D) 2 H

127. Maximum motional emf in a conductor is given by VBL. At which angle the conductor moves in magnetic field such that emf in it becomes half then its maximum value is:
(A) $0°C$ (B) $30°$ (C) $45°$ (D) $60°$

ANSWERS OF THE MULTIPLE CHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
D	C	D	C	C	C	A	B	B	D	D	A	B	A	D
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
B	C	C	B	C	C	D	D	D	A	D	D	D	C	B
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
D	D	C	C	C	C	A	B	A	B	C	D	A	C	A

46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
D	B	D	B	B	B	C	A	D	C	B	C	B	B	B
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
B	B	C	D	B	D	D	A	A	A	A	A	A	B	C
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
D	A	C	A	B	C	A	B	D	B	C	C	C	A	B
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
D	B	A	A	B	D	C	B	C	D	B	C	C	C	D
106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
A	D	D	B	C	C	D	B	D	B	C	C	C	C	C
121	122	123	124	125	126	127								
A	D	B	C	D	D	B								

SHORT QUESTIONS OF CHAPTER-15 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Induce emf and Induce current:

1. Does the induced emf always act to decrease the magnetic flux through a circuit? **(28 Times)**

Ans: No, the induced emf always opposes the cause that produces it.

- If the magnetic flux through the circuit is increasing, then induced emf acts to decrease the magnetic flux.

If the magnetic flux through the circuit is decreasing, then induced emf acts to increase the magnetic flux.

2. Show that ε and $\frac{\Delta\varphi}{\Delta t}$ have the same units. **(30 Times)**

OR Show that induced emf and rate of change of flux has the same units.

Ans: Since

$$\varepsilon = \frac{W}{q}$$

$$\varepsilon = \frac{joule}{coulomb}$$

$$\varepsilon = volt$$

and

$$\frac{\Delta\varphi}{\Delta t} = \frac{B\Delta A}{\Delta t}$$

$$\frac{\Delta\varphi}{\Delta t} = \frac{(NA^{-1}m^{-1})(m^2)}{s}$$

$$\frac{\Delta\varphi}{\Delta t} = \frac{Nm}{As}$$

$$\frac{\Delta\varphi}{\Delta t} = \frac{joule}{coulomb}$$

$$\frac{\Delta\varphi}{\Delta t} = volt$$

Thus ε and $\frac{\Delta\varphi}{\Delta t}$ have the same units.

3. Does the induced emf in a circuit depend upon the resistance of the circuit? Does the induced current depend on the resistance of the circuit? (15 Times)

Ans: Since $\varepsilon = -N\frac{\Delta\varphi}{\Delta t}$

Thus the induced emf in a circuit does not depend upon the resistance of the circuit. It depends upon the rate of change of magnetic flux.

And $I = \frac{\varepsilon}{R}$

Thus the induced current depends on the resistance of the circuit.

4. What is electromagnet? Mention two practical examples of electromagnet.

Ans: When a specimen of iron is placed inside a current carrying solenoid, it becomes an electromagnet.

Examples are

i. Transformers ii. Motors

5. Define electromagnetic induction.

Ans: When a conductor is moved through a magnetic field, the electric current flow through the circuit. The emf produced in the conductor is called induced emf, and the current generated is called induced current. This phenomenon is known as electromagnetic induction.

6. A square loop of wire is moving through a uniform magnetic field. The normal to the loop is oriented parallel to the magnetic field. Is emf induced in the loop? Give a reason for your answer. (3 times)

Ans: No, The induced emf in the wire is $\varepsilon = vBL\sin\theta$

In the present case $\theta = 0^o$, so $\varepsilon = vBL\sin 0^o$

$$\varepsilon = vBL(0)$$

$$\varepsilon = 0$$

Thus, emf induced in the loop is zero.

7. Write down any one method used for the production of induced emf.

Ans: Induced emf can be induced by electromagnetic induction.

When a conductor is moved through a magnetic field, the electric current flow through the circuit. The emf produced in the conductor is called induced emf, and the current generated is called induced current.

8. Is it possible to change both the area of the loop and magnetic field passing through the loop and still have no induced emf in the loop? Explain briefly. (11 times)

Ans: Yes, if the plane of the loop is kept parallel to the direction of the magnetic field, magnetic flux through the coil will be zero, no emf will be induced in the loop either by changing its area or by changing the magnetic field.

9. If area of the loop and magnetic field both are changing and still have no induced emf. Explain why?

Ans: If the plane of the loop is kept parallel to the direction of the magnetic field, magnetic flux through the coil will be zero, no emf will be induced in the loop either by changing its area or by changing the magnetic field.

10. Define induced emf and induced current. (4 Times)

Ans: If a conductor moves through a magnetic field then due to change in magnetic flux, an emf is induced across the ends of the conductor which is known as back emf. If the circuit is closed, it will cause an electric current which is called as induced current.

11. Name four methods to produce induce emf.

Ans: An induced emf is produced in the loop if the magnetic flux through it changes. The methods to produce induced emf are:

(i) A bar magnet is moved towards the coil.
(ii) By changing the area of the coil in a constant magnetic field.
(iii) A coil of constant area is rotated in a constant magnetic field.
(iv) The coil is placed in the magnetic field of an electromagnet.

12. Considering induced emf produced by A.C. generator of loop resistance R, correlate the instantaneous emf and maximum emf. Also instantaneous current and maximum current.

Ans: The instantaneous emf "ε" and maximum emf "ε_o" are correlated by

$$\varepsilon = \varepsilon_o \sin\theta$$

If R is the resistance of loop, then by Ohm's law instantaneous current "I" and maximum current "I_o" are correlated as

$$I = \frac{\varepsilon}{R} = \frac{\varepsilon_o \sin\theta}{R} = I_o \sin\theta$$

These relations show that both the ε & I varies sinusoidally with time.

13. A glass rod of length "L" is moving perpendicular to the applied magnetic field P with velocity v. Explain briefly about the induced emf in it.

Ans: Induced emf is zero.
As glass rod is insulator and there are no free electrons to be shifted from one extreme to the other. Therefore, there will be no effect of perpendicular magnetic field. The induced emf is only produced by moving a conductor across the magnetic field.

14. How the induced current can be increased?

Ans: The induced current can be increased by
(i) using a stronger magnetic field. (ii) moving the loop faster.
(iii) replacing the loop by a coil of many turns.

15. Define electromagnetic induction and induced emf.

Ans: When a conductor is moved through a magnetic field, the electric current flow through the circuit. The emf produced in the conductor is called induced emf, and the current generated is called induced current. This phenomenon is called

Topic II: Motional emf:

16. How should you position a flat loop of wire in a changing magnetic field so that there is no emf induced in the loop? (14 Time)

Ans: Since $\varepsilon = N\omega AB\sin\theta$
If the plane of loop of wire is placed perpendicular to changing magnetic field i.e. $\theta = 0^o$ then

$$\varepsilon = N\omega AB\sin 0^o$$
$$\varepsilon = N\omega AB(0)$$
$$\varepsilon = 0$$

Hence no emf will be induced through the loop.

17. Define motional emf and write its formula. (4 times)

Ans: If a conductor moves through a magnetic field then due to change in magnetic flux, an emf is induced across the ends of the conductor which is known as motional emf.

$$\varepsilon = vBL\sin\theta$$

Topic III: Farad Law:

18. State Faraday's law of electromagnetic induction. (13 Time)

OR State Faraday's law of electromagnetic induction. Write its mathematical form.

Ans: Its states that
"The average emf induced in a conducting coil of N loops is equal to the negative of the rate at which the magnetic flux through the coil is changing with time.

$$\text{"}\varepsilon = -N\frac{\Delta\phi}{\Delta t}$$

19. State the Lenz's law and define Henry.

Ans: **Lenz's law:**
It states that the direction of the induced current is always so as to oppose the change which causes the current.

Henry:
If current in the primary is changing at the rate of one ampere per second and the emf induced across the ends of the secondary coil is one volt then the mutual inductance is called one Henry.

Topic IV: Lenz's Law:

20. How does Lenz's law explain law of conversation of energy phenomenon of electromagnetic induction?

Ans: When a rod is moving in a magnetic field towards right, an induced current flows through the loop in anti-clock wise direction. Since current carrying rod experiences a magnetic force opposite to that of velocity. An external force equal in magnitude and opposite in direction must be applied to keep the rod moving with constant velocity. This dragging force provides the energy for the induced current to flow. This energy is the source of induced current. Thus electromagnetic induction is exactly according to law of conservation of energy.

21. **A suspended magnet is oscillating freely in the horizontal plane. The oscillations are strongly damped when a metal plate is placed under the magnet. Explain why this occurs? (3 Times)**

Ans: The oscillating magnet produces change of magnetic flux close to it. The metal plate placed below it experiences the change of magnetic flux. As the result, eddy currents are produced inside metal. According to Lenz's law, these eddy currents oppose the cause which produced it. So, the oscillations of magnet are strongly damped.

22. **State the Lenz's Law. (3 times)**

Ans: It states that the direction of the induced current is always so as to oppose the change which causes the current.

23. **A light metallic ring is released from above into a vertical bar magnet with South Pole to the upside. Does the current flow clockwise or anticlockwise in the ring?**

Ans: When the metallic ring is released from above into a bar magnet, the magnetic flux is changed in the ring and an induced emf is produced in it. According to Lenz's law, the direction of produced current is opposite to the cause which produced it. So, the side of ring facing magnet must be South Pole of the induced magnetic field. When that metallic ring viewed from above, then the current in the ring will be anticlockwise.

24. **State Lenz's law and Faraday's law of electromagnetic induction. (2 Times)**

Ans: Lenz's law:
It states that the direction of the induced current is always so as to oppose the change which causes the current.

Faraday's law:
Its states that, "The average emf induced in a conducting coil of N loops is equal to the negative of the rate at which the magnetic flux through the coil is changing with time."

$$\varepsilon = -N\frac{\Delta\phi}{\Delta t}$$

Topic V: Mutual Induction:

25. **On what factors, the mutual inductance of two coils depends? (5 times)**

Ans: Mutual inductance is given as $M = -\frac{\varepsilon_S}{\Delta I_P/\Delta t}$

So it depends upon induced emf of the secondary coil ε_S and the time rate of change in primary coil $\Delta I_P/\Delta t$.

It also depends upon number of turns of the coil, area of cross-section of the coil, closeness of coils and nature of the core materials.

26. **Define mutual induction. Write its SI unit. (6 times)**

Ans: The phenomenon in which the changing current in one coil induces an emf in another coil is called the mutual induction.

$$M = -\frac{\varepsilon_S}{\Delta I_P/\Delta t}$$

27. **In a certain region the earth's magnetic field points vertically down. When a plane flies due north, which wing tip is positively charged? (7 Times)**

Ans: The magnetic force on electron is $\vec{F_B} = -e(\vec{v} \times \vec{B})$

When the plane flies due north in the earth's magnetic field directed vertically downward, then electrons will experience force in east direction. Thus west wingtip of the plane is positively charged.

28. **Define Henry. OR Define the SI Unit of mutual inductance. (7 times)**

Ans: If current is changing at the rate of one ampere per second and the emf induced across the ends of the coil is one volt then the inductance is called one Henry.

Its S.I units are VsA^{-1}.

29. **What are the dimensions of mutual inductance? (3 times)**

Ans: Mutual inductance is given by

$$M = N\Phi/I$$

$$[M] = \frac{[N][\Phi]}{[I]}$$

number of turns "N" being a constant is dimensionless, so

$$[M] = \frac{[\phi]}{[I]}$$

$$[M] = \frac{[ML^2T^{-2}I^{-1}]}{[I]}$$

$$[M] = [ML^2T^{-2}I^{-2}]$$

30. Define mutual inductance and write at least two factors at which it depends. **(3 times)**

Ans: The ratio of average emf induced in the secondary to the time rate of change of current in the primary is called mutual inductance.

Mathematically,

$$M = \frac{\varepsilon_s}{\Delta I_P/\Delta t}$$

It depends upon number of turns of the coil, area of cross-section of the coil, closeness of coils and nature of the core materials.

31. Define mutual induction and Henry. **(2 times)**

Ans: The phenomenon in which a changing current in one coil induces an emf in another coil is called the **mutual induction**.

One henry is the mutual inductance of the pair of coils in which the rate of change of current of one ampere per second in the primary causes an induced emf of one volt in the secondary.

32. Define mutual inductance of the coils and also define its unit henry.

Ans: The ratio of average emf induced in the secondary to the time rate of change of current in the primary is called **mutual inductance.**

If current in the primary is changing at the rate of one ampere per second and the emf induced across the ends of the secondary coil is one volt then the mutual inductance is called **one henry.**

Topic VI: Self-Induction:

33. Define self-induction. Write its SI unit. **(3 times)**

OR Define self-inductance and its unit.

Ans: The phenomenon in which the changing current in a coil induces an emf in itself is called the self-induction.

$$L = -\frac{\varepsilon_L}{\Delta I/\Delta t}$$

Its SI unit is VsA^{-1}. It is also called as $henry\ (H)$.

34. Name the factors upon which the self-inductance depends. **(9 Time)**

Ans: Since $L = -\frac{\varepsilon_L}{\Delta I/\Delta t}$

It depends upon induced emf and time rate of change of current in the coil. It also depends upon the number of turns of the coil, its area of cross-section and the core material.

35. Define self-induction and mutual induction.

Ans: The phenomenon in which a changing current in a coil induces an emf in itself is called **self-induction.**

The phenomenon in which a changing current in one coil induces an emf in another coil is called **mutual induction.**

36. Define self induction and self inductance.

Ans: The phenomenon in which a changing current in a coil induces an emf in itself is called **self induction.**

Self inductance is defined as "the ratio of the emf to the rate of change of current in the coil".

$$L = \frac{\varepsilon_L}{\Delta I/\Delta t}$$

Topic VIII: Alternating Current Generator:

37. What are the factors on which maximum value ε_0 of emf induced across terminals of armature of an A.C generator depend?

Ans: Since $\varepsilon_0 = N\omega AB$

This shows that maximum value of Induced emf depend upon

i. Number of turns ii. Angular frequency iii. Area of the loop
iv. Magnetic field v. Angle between area of the loop A and magnetic field B.

38. What happen to the current of a circuit if a load resistance of the circuit is much less than the power transferred?

Ans: The greater the load the larger the current is supplied by the generator. When the load resistance of the circuit is much less, small current is supplied by the generator.

Topic IX: D.C Generator:

39. Why is split ring used in DC generator in place of slip rings?

Ans: The split rings are two halves of a ring that act as commutator. When the current in the coil is zero and is about to change direction, the split rings also changes the contacts with the carbon brushes. Therefore, the output remains in the same direction although the current is not constantan magnitude.

40. Write two similarities and two differences between motor and generator. **(2 times)**

Ans: Similarities

i. Construction of a motor is similar to a generator.
ii. In both, magnetic field is provided by an electromagnet.

Differences

i. Generator converts mechanical energy into electrical energy while motor converts electrical energy into mechanical energy.
ii. In generator, the armature coil is rotated in the magnetic field and current is the output. While in motor, armature is connected to battery, which rotates the armature.

41. What is mean by commutator in D.C generator?

Ans: Commutator consists of two split rings or two halves of a single ring. Each half of split ring is connected to each end of the rotating coil. It helps to maintain the output in the same direction by inverting lower halves of sine curve.

42. How fluctuations of the output can be reduced in D.C generator?

Ans: The fluctuations can be reduced by using many coils rather than a single one. Multiple coils are wound on a cylindrical core in form of armature. Each coil is connected to a separate commutator to tap the output at the peak value. Thus the emf in the outer circuit is almost constant.

Topic X: Back Motor Effect In Generators:

43. What is back motor effect in generators? **(7 Times)**

Ans: Back motor effect is the opposing torque produced due to the induced emf in the coil. When coil rotates, a current is drawn through the coil. The magnetic field exerts two equal and opposite forces on left and right side of the current carrying coil. These forces are such that they produce a counter torque that opposes the rotational motion of the coil. This effect is known as back motor effect in generators.

Topic XI: D.C Motor:

44. What changes are required to turn the D.C motor into a D.C generator? (3 Times)

Ans: i. In order to convert DC motor into a DC generator, the magnetic field must be supplied by the permanent magnet and not by electromagnet.
ii. An arrangement to rotate the coil armature should be provided and battery must be removed.

45. Can an electric motor be used to derive an electric generator with output from the generator being used to operate the motor? **(7 Times)**

Ans: No it is not possible. Because if it is possible, it will be a self operating system without getting energy from some external source and this is against the law of conservation of energy.

46. What is DC motor? Write its principle.

Ans: AD.Cmotor is a device which converts D.C electrical energy into mechanical energy. The basic principle of electric motor is that a current carrying coil placed in magnetic field experiences a torque which is given by

$$\tau = NIAB\cos\alpha$$

47. Why does a motor draw more current when it is over loaded?

Ans: If the motor is overloaded, it slows down. Consequently, the back emf decreases and allows motor to draw more current. And If the motor is overloaded beyond its limits, the current could be so high that it may burn out the motor.

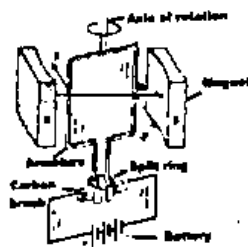
$$I = \frac{V - \varepsilon}{R}$$

48. Can D.C motor be turned into a D.C generator? What changes are required to be

done? (10 times)

Ans: Yes, a D.C motor can be converted into a D.C generator.
For this the armature coil of the motor is to be coupled with some rotating body. Due to rotation, magnetic flux through the coil changes and so an emf will be induced at the output. Hence the motor acts as a generator.

49. Draw and label the diagram of a D.C motor.

Ans:

50. Can an emf be produced in a D.C motor? Would it be possible to use motor as a generator or source?

Ans: Yes, when a motor is running, its armature is rotating in a magnetic field. Magnetic flux is changing through armature which produces an induced emf.
Yes, It will be possible to use motor as a generator.
If the rotational motion of any body is transferred to the armature of the motor then due to its rotation, magnetic flux through the coil changes and so an emf will be induced at the output.

51. What is D.C motor? Write down parts of D.C motor.

Ans: D.C motor is a device which converts electrical energy into mechanical energy.
Main parts of D.C motor are commutator, armature and permanent magnet or electromagnet.

52. What is the function of the commutator in D.C motor?

Ans: When current flows through the armature coil all the time in the same direction, the torque on it would be reversed after each half revolution.
But this moment, commutator reverses the direction of current that keeps the torque always in the same sense.

53. Discuss the relation: $V = \varepsilon + IR$

Ans: When you want to charge the battery with V volts, the battery gets charged with E volts only and remaining IR volts is the voltage drop due to total resistance (internal + external).

54. What is difference between D.C. generator and D.C. motor?

Ans: (i) Generator converts mechanical energy into electrical energy while motor converts electrical energy into mechanical energy.
(ii) In generator, the armature coil is rotated in the magnetic field and current is produced. While in motor, current is given to the armature and armature starts to rotate.

Topic XII: Back emf Effect in motor:

55. What is back emf effect in motor? (7 Times)

Ans: When the coil motor rotates across the magnetic field by the applied potential difference V,anemf is induced in it. The induced emf is in such a direction that opposes the emf running motor. Due to this reason, the induced emf is called back emf of the motor. The magnitude of the back emf increases with the speed of motor.

56. What is meant by Back emf? Write its SI units.

Ans: The emf induced across the ends of a coil due to the changing current in the same coil is called self-induced emf or back emf. Its S.I unit is volt (V).

57. Define induced emf and back emf of a motor.

Ans: An emf is set up in a conductor when it moves across a magnetic field. It is called an **induced emf.**
The induced emf in a motor opposes the emf running the motor. This induced emf is called the **back emf of the motor.**

Topic XIII: Transfarmer:

58. Can a step-up transformer increase the power level? (9 Time)

Ans: No, a step up transformer cannot increase the power level.
In actual transformer, due of dissipation of energy in the coil, the output power is always less than input power. Therefore, a step-up transformer can't increase power level.

59. When the primary of a transformer is connected to A.C mains, the current in it is very small if the secondary circuit is open. Explain.

Ans: If the secondary circuit is open, then output power will be zero. Because output power is always slightly smaller than the input power, therefore a very small value of current is being drawn by a primary coil of transformer form AC mains.

60. When an electric motor such as drill, is being used, does it also act as a generator? If so what is the consequence of this? (2 Times)

Ans: Yes, when an electric motor is running, its armature is rotating in a magnetic field. A torque acts on the armature and at the same time, magnetic flux ischanging through the armature which produces an induced emf. The induced emf opposes the rotation of armature. This means that motor also acts as generator when it is running.

61. Four unmarked wires emerged from a transformer. What steps would you take to determine the turns ratio? (13 Time)

Ans: By checking continuity of the coils with the help of ohmmeter, the coils are separated as primary and secondary coils. An A.C voltage $V_p$is supplied to primary and V_s is measured. The turn ratio of the coil is determined by using relation:

$$\frac{N_S}{N_P} = \frac{V_S}{V_P}$$

62. In a transformer there is no transfer of charge from the primary to the secondary. How is then the power transferred? (7 Time)

Ans: The power will be transferred because the two coils of transformer are magnetically linked i.e., the change of flux through one coil is linked with the other coil.

63. Name and explain the factors responsible for power loss in transformer. (3 Times)

Ans: There are two main causes of power loss.

i. ***Eddy Currents:*** The induced currents that are set up in the core of transformer in the direction perpendicular to the flux are known as eddy currents. It results in power dissipation and heating of the core material.

ii. ***Hysteresis Loss:*** Hysteresis loss is the energy expended to magnetize and demagnetize the core material in each cycle of AC.

64. Differentiate between step up and step down transformer.

Ans: <u>Step up transformer:</u> A transformer in which voltage across secondary is greater than the primary voltage is called step up transformer.

$$V_S > V_P$$
$$N_S > N_P$$

<u>Step down transformer:</u> A transformer in which voltage across secondary is less than the primary voltage is called step up transformer.

$$V_S < V_P$$
$$N_S < N_P$$

Its SI unit is VsA^{-1}. It is also called as $henry\ (H)$.

65. How the power is lost due to eddy current in a transformer and how this loss can be minimized?

Ans: The induced currents that are set up in the core of transformer in the direction perpendicular to the flux are known as eddy currents. It results in power dissipation and heating of the core material.
The insulation between lamination sheets should be perfect so as to stop the flow of eddy currents.

66. How can the power losses be minimized in a transformer? (3 Times)

Ans: The power losses can be minimized in a transformer by implementing following considerations.

I. Core should be assembled from the laminated sheet of a material whose hysteresis loop area is very small.
II. The insulation between lamination sheets should be perfect so as to stop the flow of eddy currents.
III. The resistance of the primary and secondary coils should be kept minimum.

67. What is working principle of a transformer? Explain it.

Ans: The transformer works on the principle of mutual induction between two coils. The transformer consists of two coils of copper electrically insulated from each other, wound on the same iron core. The coil to which AC power is supplied is called primary and that from which power is delivered to the circuit is called secondary.

68. When the primary of a transformer is connected to AC mains the current in it increases when secondary circuit is closed. Explain why? (3 Times)

Ans: When the secondary circuit is closed, the output power increases. To produce this power, transformer will draw large current from the A.C mains to increase its primary power.

69. Distinguish between AC generator and transformer. (3 Times)

Ans: AC generator AC generator is a device which produces AC voltage by converting mechanical energy into electrical energy

Transformer It is an electrical device which acts to change a given alternating emf into a larger or smaller AC voltage.

70. What do you mean by Eddy current?

Ans: As magnetic flux changes through a solid conductor, induced current is set up in closed paths in the body of the conductor. This induced current is set up in a direction perpendicular to the flux and is known as eddy currents. It results in power dissipation and heating of the core material.

71. Why transformers are used in the A.C supply network? (2 Times)

Ans: A transformer acts to change a given alternating emf into a larger or smaller AC voltage. Transformers are used in the A.C supply network to decrease heating loss and to send electricity to long distances at very low power loss and at low cost because it increases the voltage and reduces the current.

72. How the efficiency of a transformer can be improved? (3 Times)

Ans: Two main sources of power loss in transformers are eddy currents and hysteresis loss which can be minimized to improve efficiency of transformers by using laminated sheets of a material whose hysteresis area is very small, Insulating between the laminated sheets, placing coils side by side and by making the resistance of primary and secondary coils very small.

73. Can a transformer be used with D.C? Explain.

Ans: No,

As transformer works on the principle of electromagnetic induction, which is produced by A.C and not by D.C. To induce a voltage in the secondary coil it is necessary to have magnetic flux change.

74. Can a step-up transformer increase the power level? In a transformer, there is no transfer of charge from the primary to the secondary, How is then the power transferred?

Ans: No, a step – up transformer cannot increase the power level.

In a transformer, the two coils are magnetically linked i.e, the change of flux through one coil is linked with the other coil.

75. What is transformer? What is its working principle?

Ans: Transformer is an electrical device which is used to change a given alternating emf into a larger or smaller alternating emf.

It works on the principle of mutual induction between two coils.

76. What is meant by efficiency of transformer? Write few steps to improve the efficiency of transformer.

Ans: The efficiency of a transformer is defined as

$$E = \frac{output\ power}{input\ power} \times 100$$

Efficiency can be improved by using laminated sheets of a material whose hysteresis area is very small, insulating between the laminated sheets, placing coils side by side and by making the resistance of primary and secondary coils very small.

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77. **What is the importance/significance of minus sign in the expression ($\varepsilon = -N\frac{\Delta\varphi}{\Delta t}$) of Faraday's law of electromagnetic induction? (2 Times)**

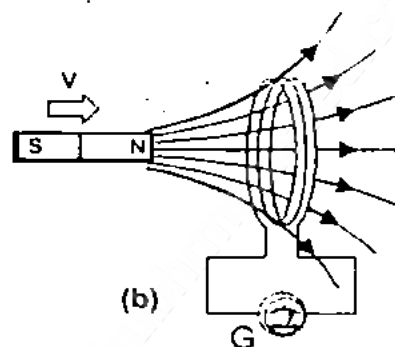
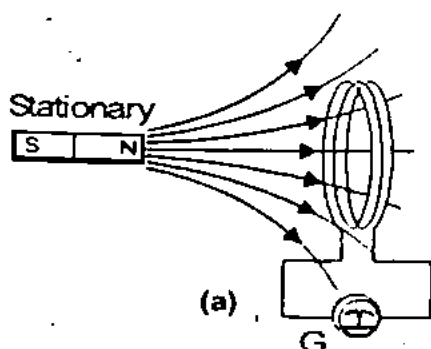
Ans: The minus sign indicates that the direction of induced emf is such that it opposes the change in flux. This expression tells that the emf induced in a conducting coil of N loop is equal to the negative of the rate at which the magnetic flux through the coil is changing with time.

78. **Why self-induced emf is also called as back emf? (2 Times)**

Ans: When the coil motor rotates across the magnetic field by the applied potential difference V, an emf is induced in it. The induced emf is in such a direction that opposes the emf running motor. Due to this reason, the induced emf is called back emf of the motor. The magnitude of the back emf increases with the speed of motor.

79. **How an emf is induced in a coil of wire using a bar magnet?**

Ans: Figure (a) shows a bar magnet and a coil of wire to which a galvanometer is connected. When there is no relative motion between the magnet and the coil, the galvanometer indicates no current in the circuit. As soon as the bar magnet is moved towards the coil, a current appears in it figure (b). As the magnet is moved, the magnetic flux through the coil changes, and this changing flux produces the induced current in the coil. When the magnet moves away from the coil, a current is again induced but now in opposite direction. The current would also be induced if the magnets were held stationary and the coil is moved.

(a) (b)

80. **A metal rod of length 25 cm is moving at a speed of 0.5 ms^{-1} in a direction perpendicular to a 0.25 T magnetic field. Find the emf produced in the rod.**

Speed of rod = v = 0.5 ms^{-1}

Length of rod = L = 25 cm = 0.25 m

Magnetic flux density = B= 0.25 T=0.25 NA^{-1} m^{-1}

Induced emf = ε =?

Using the relation,

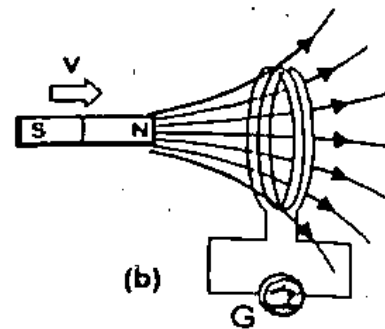
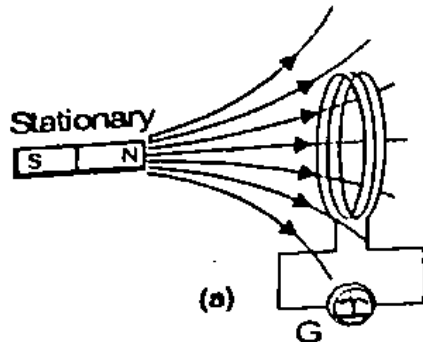
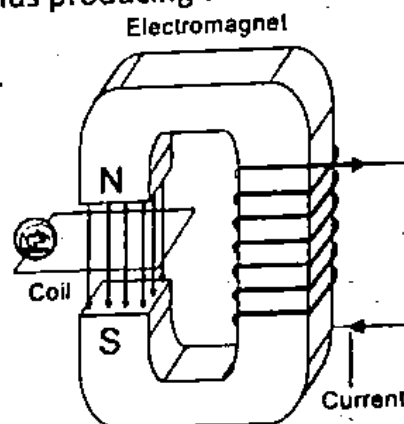
$$\varepsilon = vBL$$

$$\varepsilon = 0.5ms^{-1} \times 0.25NA^{-1}m^{-1} \times 0.25m$$

$$\varepsilon = 3.13\times10^{-2} JC^{-1} = 3.13\times10^{-2} V$$

81. **Write down the two methods for producing the induced emf in a loop.**

Ans: i. Figure (a) shows a bar magnet and a coil of wire to which a galvanometer is connected. When there is no relative motion between the magnet and the coil, the galvanometer indicates no current in the circuit. As soon as the bar magnet is moved towards the coil, a current appears in it figure (b). As the magnet is moved, the magnetic flux through the coil changes, and this changing flux

produces the induced current in the coil. When the magnet moves away from the coil, a current is again induced but now in opposite direction. The current would also be induced if the magnets were held stationary and the coil is moved.

II. It is also possible to link the changing magnetic flux with a coil by using an electromagnet instead of a permanent magnet. The coil is placed in the magnetic field of an electromagnet. Both the coil and the electromagnet are stationary. The magnetic flux through the coil is changed by changing the current of the electromagnet, thus producing the induced current in the coil.

82. How an emf is induced in a coil placed in a constant magnetic field? (Hint: Basic principle used in electric generators).

Ans: When a coil is rotated in a constant magnetic field by some mechanical means, magnetic flux through the coil changes, and consequently an emf is induced in the coil.

83. Describe the working principle and use of AC generator.

Ans: Principle: The principle of an electric generator is based on Faraday's law of electromagnetic induction. When a coil is rotated in a constant magnetic field by some mechanical means, magnetic flux through the coil changes, and consequently an emf is induced in the coil.

Use: AC generator is a used to produces AC voltage by converting mechanical energy into electrical energy in electrical appliances such as power plants, electric scooters, sailboats, bicycles, etc.

84. What will be the energy density of the current carrying solenoid if the magnetic field is doubled?

Ans: The energy density is given as $\frac{B^2}{2\mu_o}$.

Given that $B = 2B$ then the energy density is increased by 4 times.

85. Does the self-inductance depend on the rate of change of current?

Ans: Since $L = -\frac{\varepsilon_L}{\Delta I/\Delta t}$

It depends upon induced emf and time rate of change of current in the coil. It also depends upon the number of turns of the coil, its area of cross-section and the core material.

LONG QUESTIONS OF CHAPTER-15 IN ALL PUNJAB BOARDS 2011-2021

Topic II: Motional emf:

1. Define motional emf and derive a relation for it. **(4 Times)**

Topic III. Faradays Law:

2. State and prove the Faraday's law of electromagnetic induction. **(5 Times)**

Topic IV: Lenz's Law:

3. State Lenz's law. Explain how this law explains conservation of energy during electromagnetic induction.

Topic V: Mutual Induction:

4. Define and explain mutual induction. Also derive relation for mutual inductance.
5. Define and explain the phenomena of mutual induction. Also give S.I unit. **(5 Times)**

Topic VI. Self-Induction:

6. Define self-induction. Explain how energy is stored in magnetic field. Also find energy density.

Topic VII: Energy Stored in an Inductor:

7. What is an inductor? Derive the relation for energy stored in an inductor. **(2 Times)**
8. Define energy density. Prove that energy density is directly proportional to the square of magnetic field. **(2 Times)**
9. Why is energy stored in an inductor when a current flows in it? Derive relation for energy density of magnetic field.

Topic VIII: Alternating Current Generator:

10. What is alternating current generator? Describe its principle, construction and working. Also derive an expression for induced emf and induced current. **(7 Times)**

Topic XI: Transformer:

11. What is a transformer? Derive its equation. Also explain power losses and power transmission in it.
12. What is Transformer? Describe its principle, construction and working of Transformer and types. **(2 Times)**
13. What is transformer? Describe its principle, construction, working and types. **(2 times)**

NUMERICAL PROBLEMS OF CHAPTER-15 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Induce emf and Induce current:

1. **A metal rod of length 25 cm is moving at a speed of 0.5 ms^{-1} in direction perpendicular to a 0.25 T magnetic field. Find emf produced along the rod. (5 times)**

Ans: Given that

$$v = 0.5\ ms^{-1}$$
$$L = 25\ cm = 0.25\ m$$
$$B = 0.25\ T$$
$$\theta = 90^o$$
$$\varepsilon = ?$$

So

$$\varepsilon = vBL\sin\theta$$
$$\varepsilon = (0.5)(0.25)(0.25)\sin 90^o$$
$$\varepsilon = 0.03125$$
$$\varepsilon = 3.125\times10^{-2}\ V = 3.13\times10^{-2}\ V$$

2. **A solenoid has 250 turns and its self-inductance is 2.4 mH. What is the flux through each turn when the current is 2A? What is the induced emf when the**

current changes at the rate of 20 As^{-1}? (3 Times)

Ans: Given that

$$\text{number of turns} = N = 250 \text{ turns}$$
$$\text{self induction} = L = 2.4 \text{ mH} = 2.4 \times 10^{-3} H$$
$$\text{current} = I = 2 A$$
$$\text{rate of change of current} = \frac{\Delta I}{\Delta t} = 20 \ As^{-1}$$
$$\text{emf} = \varepsilon = ?$$
$$\text{flux through each turn} = \phi = ?$$

We know

$$L = \frac{N\phi}{I}$$
$$\phi = \frac{LI}{N}$$

Putting the values,

$$\phi = \frac{2.4 \times 10^{-3} \times 2}{250} \boxed{= 1.92 \times 10^{-5} \text{ Wb}}$$

Now,

$$\varepsilon = L\frac{\Delta I}{\Delta t}$$

Putting the values,

$$\varepsilon = 2.4 \times 10^{-3} \times 20 = 0.048 \text{ V}$$
$$\varepsilon = 48 \times 10^{-3} \text{ V} \boxed{= 48 \times 10^{-3} \text{ mV}}$$

3. A loop of a wire is placed in a uniform magnetic field that is perpendicular to plane of a loop. The strength of magnetic field is 0.6T. The area of loop begin to shrink at a constant rate of $\Delta A / \Delta t = 0.8 m^2 s^{-1}$. What is the magnitude of emf induce in the loop while it is shrinking?

Sol:

$$\frac{\Delta A}{\Delta t} = 0.8 m^2 s^{-1}$$
$$B = 0.6T$$
$$\varepsilon = ?$$

Rate of change of flux

$$\frac{\Delta\phi}{\Delta t} = \frac{B\Delta A}{\Delta t}\cos 0^0$$
$$\frac{\Delta\phi}{\Delta t} = \frac{B\Delta A}{\Delta t}(1) = B\frac{\Delta A}{\Delta t}$$

Applying Faraday's law

$$\varepsilon = N\frac{\Delta\phi}{\Delta t}$$
$$= N \times \frac{B\Delta A}{\Delta t}$$

Putting values, we get

$$\varepsilon = 1 \times 0.6 \times 0.8$$
$$\varepsilon = 0.48V$$

4. A coil of 10 turns and 35cm²area is in a perpendicular magnetic field of 0.5T. The coil is pulled out of the field in 1.0s. Find the Induced emf in the coil as it is pulled out of the field. (5 times)

Sol:

$r = 4.0\,cm = 4\times10^{-2}\,m$

$R = 1.0\,m\Omega$

$R = 1.0\times10^{-3}\,\Omega$

$B_1 = 0.2\,T$

$B_2 = 0.4\,T$

$\Delta t = 5\times10^{-3}\,s$

$N = 1$

$I = ?$

$\Delta B = B_2 - B_1$

$\Delta B = 0.4 - 0.2 = 0.2\,T$

By definition

$\phi_B = \vec{B}.\vec{A}$

$\phi_B = BA\cos\theta$

$\phi_B = BA\cos 0$

$(\cos 0^0 = 1)$

$\phi_B = BA(1)$

$\because\ (A = \pi r^2)$

$\Delta\phi_B = \Delta(B\pi r^2)$

$\Delta\phi_B = \Delta B\pi r^2$

As

$$\varepsilon = N\frac{\Delta\phi}{\Delta t}$$

$$\varepsilon = N\frac{\Delta B\times\pi r^2}{\Delta t}$$

$$\varepsilon = (1)\times\frac{0.20\times3.14\times(4\times10^{-2})^2}{5\times10^{-3}}$$

$$\varepsilon = \frac{10.048}{5}\times10^{-1}$$

$$\varepsilon = 0.201\,V$$

From ohm's law

$$I = \frac{\varepsilon}{R}$$

$$I = \frac{0.201}{1\times10^{-3}} = 201\,A$$

5. A circular coil has 15 turns of radius = 2cm each. The plane of the coil lies at 40^0 to a uniform magnetic field of 0.2T. if the field is increased by 0.5T in 0.2 s, find the magnitude of induced emf.

$N = 15\ turns$

$r = 2cm = 0.02\,m$

Angle between $\overrightarrow{B}$ and plane of coil $\theta' = 40^0$

Angle between $\overrightarrow{B}$ and vector Area $\overrightarrow{A} = \theta = 90^0 - \theta'$

$\theta = 90^0 - 40^0$

$\theta = 50^0$

$B_1 = 0.2T$

$B_2 = 0.5T$

$\Delta B = B_2 - B_1 = 0.5 - 0.2 = 0.3T$

$\Delta t = 0.2\,s$

$\varepsilon = ?$

as $\quad \varepsilon = -N\dfrac{\Delta\phi}{\Delta t}$

or $\quad \varepsilon = -N\dfrac{\Delta BA\cos\theta}{\Delta t}$

$$\left(\because \Delta\phi = \overrightarrow{\Delta B}.\overrightarrow{A} = \Delta BA\cos\theta\right)$$

or $\quad \varepsilon = -N\dfrac{\Delta B\pi r^2\cos\theta}{\Delta t}$

$$\left(\because A = \pi r^2\right)$$

Putting values, we get

$$\varepsilon = -15\frac{(0.3)(3.14)(0.02)^2\cos 50^0}{0.2}$$

or $\quad \varepsilon = 1.82\times10^{-2}V$

$\varepsilon = 1.82\times10^{-2}V$

Topic II: Motional emf:

6. An emf of $0.45\,V$ is induced between the ends of a metal bar moving through a magnetic field of $0.22\,T$. What field strength would be needed to produce an emf of $1.5\,V$ between the ends of the bar, assuming that all the other factors remain the same.

Ans:

Given that $\quad \varepsilon_1 = 0.45\,V$

$B_1 = 0.22\,T$

$\varepsilon_2 = 1.5\,V$

$$B_2 = ?$$

Since $\varepsilon_1 = B_1 vL \sin\theta$

$$\frac{\varepsilon_1}{B_1} = vL\sin\theta$$

And $\varepsilon_2 = B_2 vL \sin\theta$

$$\frac{\varepsilon_2}{B_2} = vL\sin\theta$$

On comparison, we get

$$\frac{\varepsilon_1}{B_1} = \frac{\varepsilon_2}{B_2}$$

$$B_2 = \frac{\varepsilon_2 B_1}{\varepsilon_1}$$

$$B_2 = \frac{(1.5)(0.22)}{0.45} \boxed{= 0.73\,T}$$

7. **A square coil of side 16 cm has 200 $turns$ and rotates in a uniform magnetic field of $0.05T$. If the peak emf is 12 V, what is the angular velocity of the coil?** **(5 Time)**

Ans: Given that Peak $emf = \varepsilon_0 = 12\,V$

$$number\ of\ turns = N = 200\ turns$$

$$area\ of\ coil = A = 16\,cm \times 16\,cm = 256\,cm^2 = 2.56 \times 10^{-2}\,m^2$$

$$magnetic\ field = B = 0.05\,T$$

$$\omega = ?$$

As $\varepsilon_0 = B\omega NA$

$$\omega = \frac{\varepsilon_0}{BNA}$$

$$\omega = \frac{12}{0.05 \times 200 \times 2.56 \times 10^{-2}} \boxed{= 47\,rad\,s^{-1}}$$

Topic V: Mutual Induction:

8. **A pair of adjacent coil has mutual inductance of 0.75 H. If the current in the primary changes from 0 to 10 A in 0.025 sec, what is the average induced emf in the secondary.** **(2 times)**

Ans:

$$\text{number of turns} = N = 500$$

$$\text{change of current in primary coil} = \Delta I = 10 - 0\,A = 10\,A$$

$$\text{time interval} = \Delta t = 0.025\,s$$

$$\text{mutual induction} = M = 0.75\,H$$

$$\text{emf in secondary} = \varepsilon = ?$$

$$\text{change flux in secondary} = \Delta\phi = ?$$

We know,

$$\varepsilon = M\frac{\Delta I}{\Delta t}$$

Putting the values,

$$\varepsilon = 0.75\frac{10}{0.025}$$

$$\boxed{\varepsilon = 300\,V}$$

Now for flux by Lenz's Law,

$$\varepsilon = -N\frac{\Delta\phi}{\Delta t}$$

$$-\Delta\phi = \varepsilon\frac{\Delta t}{N}$$

Putting the values,

$$\Delta\phi = -300\frac{0.025}{500} = -\frac{7.5}{500}$$

$$\Delta\phi = -0.015\,Wb$$

$$\boxed{\Delta\phi = 1.5 \times 10^{-2}\ Wb}$$

Note: -ve sign show that Induced emf always oppose it's cause of production.

9. Two coils are placed side by side. An emf of 0.8V is observed in one coil when the current is changing at the rate of 200As⁻¹ in the other coil. What is the mutual induction of the coil? (2 Times)

Ans:

$$\text{rate of change of current} = \frac{\Delta I}{\Delta t} = 200\ As^{-1}$$

$$\text{emf in one coil} = \varepsilon = 0.8\ V$$

$$\text{mutual induction} = M = ?$$

We know,

$$\varepsilon = M\frac{\Delta I}{\Delta t}$$

$$M = \frac{\varepsilon}{\left(\frac{\Delta I}{\Delta t}\right)}$$

Putting the values,

$$M = \frac{0.8}{200} = 4 \times 10^{-3}\ H$$

$$\boxed{M = 4\ mH}$$

Topic VI: Self-Induction:

10. The current in a coil of 1000 *turns* is changed from 5 *A* to zero is 0.2 *s*. If an average emf of 50 *V* is induced during this interval, what is the self-inductance of the coil?

Ans: Given that $change\ in\ current = \Delta I = 5 - 0 = 5\ A$

$$time\ interval = \Delta t = 0.2\ s$$

$$emf\ induced = \varepsilon = 50\ V$$

$$self\ induction = L = ?$$

$$number\ of\ turns = N = 1000$$

Since

$$L = \frac{\varepsilon}{\Delta I/\Delta t}$$

$$L = \frac{50}{5/0.2} = 2\ VsA^{-1}\ \boxed{= 2\ H}$$

Topic VII: Energy Stored in an Inductor:

11. A solenoid coil 10.0 cm long has 40 turns per cm. When the switch is closed, the current rises from zero to its maximum value 5.0 A in 0.01s. Find the energy stored in the magnetic field if the area of cross section of the solenoid is 28 cm². (2 times)

Ans: Given that length of the solenoid $= l = 15\ cm = 0.15\ m$

$$\text{number of turns} = N = 40\ \text{per cm} = 4000\ \text{turns per m}$$

$$\text{current} = I = 5\ A$$

$$\text{time interval} = \Delta t = 0.01\ s$$

$$\text{Area of cross section} = A = 28\ cm^2 = 28 \times 10^{-4}\ m^2$$

$$\text{Energy stored} = ?$$

Since

$$\text{Energy stored} = \frac{1}{2}LI^2$$

As value of L is unknown so first we calculate the inductance L by this relation,

$$L = \mu_0 n^2 A l$$

Putting the values,

$$L = 4\pi \times 10^{-7} \times (4000)^2 \times 28 \times 10^{-4} \times 0.1$$

$$L = 562.6 \times 10^{-7} \times 10^6 \times 10^{-4}$$

$L = 562.6 \times 10^{-5}$

$L = 5.62 \times 10^{-1} H$

Using first equation, $U_m = \frac{1}{2} \times 5.63 \times 10^{-1} \times (5)^2$

$U_m = \frac{1}{2} \times 5.63 \times 10^{-1} \times 25$ $\boxed{= 7.04 \times 10^{-2} J}$

12. **When current through a coil changes from 100 mA to 200 mA in 0.005s an induced emf of 40 mV is produced in coil.**

(i) What is the self-inductance of the coil?

(ii) Increase in the energy stored in the coil.

Ans:

$$I_1 = 100\ mA = 0.1A$$
$$I_2 = 20\ mA = 0.2A$$
$$\Delta I = I_2 - I_1 = 0.2 - 0.1 = 0.1A$$
$$\Delta t = 0.005s$$
$$\epsilon = 40\ mV = 40 \times 10^{-3} V$$
$$L = ?\ ,\Delta E = ?$$

As we know that $L = E \Big/ \frac{\Delta I}{\Delta t} = 40 \times 10^{-3} \Big/ \frac{0.1}{0.005}$

$$L = 2 \times 10^{-3} H = 2mH$$

As $\Delta E = \frac{1}{2} L I_2^2 - \frac{1}{2} L I_1^2$

$$= \frac{1}{2} L\ (I_2^2 - I_1^2)$$
$$= \frac{1}{2} \times 2 \times 10^{-3}\ (0.2^2 - 0.1^2)$$
$$\Delta E = 0.03 \times 10^{-3} J$$
$$\Delta E = 0.03\ mJ$$

Topic VIII: Alternating Current Generator:

13. **It is desired to make an A.C generator that can produce an emf of a maximum value of $5\ kV$ with $50\ Hz$ frequency. A coil of area $1\ m^2$ consisting of $200\ turns$ is used as armature.**

Ans: Given that $maximum\ emf = \varepsilon_0 = 5\ kV = 5000\ V$

$$frequency = f = 50\ Hz$$
$$number\ of\ turns = N = 200\ turns$$
$$area\ of\ coil = A = 1\ m$$
$$magnetic\ field = B = ?$$

As $\varepsilon_0 = B\omega NA$

$$B = \frac{\varepsilon_0}{\omega NA}$$
$$B = \frac{\varepsilon_0}{2\pi f NA}$$
$$B = \frac{5000}{2 \times 3.14 \times 50 \times 200 \times 1} \boxed{= 0.08\ T}$$

Topic IX: D.C Generator:

14. **A permanent magnet D.C motor is run by a battery of $24\ volts$. The coil of motor has a resistance of $2\ ohms$. It develops a back emf of $22.5\ volts$ when deriving the load at normal speed. What is the current when the motor just starts up?**

Ans: Given that

$$V = 24\ V$$
$$R = 2\ \Omega$$
$$\varepsilon = 22.5\ V$$
$$I = ?$$

Since $V = \varepsilon + IR$

When motor just starts up $\varepsilon = 0$

So $V = IR$

$$I = \frac{V}{R} = \frac{24}{2} \boxed{= 12\,A}$$

15. The back emf in motor is 120 V when motor is turned at 1680 $^{rev}/_{min}$. What is the back emf when the motor turns 3360 $^{rev}/_{min}$? (3 times)

Ans: Given that

$$\omega_1 = 1680\ ^{rev}/_{min}$$
$$\varepsilon_1 = 120\,V$$
$$\omega_2 = 3360\ ^{rev}/_{min}$$
$$\varepsilon_2 = ?$$

Since $\varepsilon_1 = B\omega_1 NA$

$$\frac{\varepsilon_1}{\omega_1} = BNA$$

And $\varepsilon_2 = B\omega_2 NA$

$$\frac{\varepsilon_2}{\omega_2} = BNA$$

On comparison $\frac{\varepsilon_1}{\omega_1} = \frac{\varepsilon_2}{\omega_2}$

$$\varepsilon_2 = \frac{\varepsilon_1\omega_2}{\omega_1}$$

$$\varepsilon_2 = \frac{(120\,V)(3360\,rev/min)}{1680\,rev/min} \boxed{= 240\,V}$$

16. A DC motor operates at 240 V and has resistance of 0.5 Ω. When the motor's running at normal speed, the armature current is 15 A. Find the back emf in the armature.

Ans: Given that $operating\ voltage = V = 240\,V$

$$resistance = R = 0.5\,\Omega$$
$$armature\ current = I = 15\,A$$
$$back\ emf = \varepsilon = ?$$

Since $V = \varepsilon + IR$

$$\varepsilon = V - IR$$
$$\varepsilon = 240 - (15)(0.5) \boxed{= 232.5\,V}$$

Topic XIII: Transformer:

17. An ideal step down transformer is connected to main supply of 240 $volt$. It is desired to operate a 12 $volt$, 30 $watt$ lamp. Find the current in the primary and transformation ratio. (2 times)

Ans:

Given that

$$primary\ voltage = V_P = 240\,V$$
$$secondary\ voltage = V_S = 12\,V$$
$$output\ power = P_S = 30\,W$$
$$current\ in\ primary = I_P = ?$$
$$turnsformation\ ratio = \frac{N_S}{N_P} = ?$$

Since $input\ power = output\ power$

$$P_P = P_S$$
$$V_P I_P = P_S$$
$$I_P = \frac{P_S}{V_P}$$
$$I_P = \frac{30}{240} \boxed{= 0.125\,A}$$

And transformation ratio is

$$\frac{N_S}{N_P} = \frac{V_S}{V_P}$$
$$\frac{N_S}{N_P} = \frac{12}{240} \boxed{= \frac{1}{20}}$$

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18. **An alternating current generator operating at 50 Hz has a coil of 200 turns. The coil has an area of 120 cm². What should be the magnetic field in which the coil rotates in order to produce an emf of maximum value of 240 volts?**

Frequency of rotation = f = 50 Hz

No. of turns of the coil = N= 200

Area of the coil = A = 120 cm² = 1.2x 10² m²

Maximum emf = ε_{max} = 240 V

Magnetic flux density = B = ?

$$\omega = 2\pi f$$

$$\omega = 2\times\frac{22}{7}\times 50 = 314.3\, rad\, s^{-1}$$

Using $\varepsilon_o = N\omega AB$ or $B = \frac{\varepsilon_o}{N\omega A}$

$$B = \frac{240V}{200\times 314.3\, rad\, s^{-1}\times 1.2\times 10^{-2} m^2}$$

$$B = 0.32\ Vs\ rad^{-1} m^{-2} = 0.32T$$

19. **Like any field, the earth's magnetic field stores energy. Find the magnetic energy stored in a space where strength of earth's field is 7 x 10⁻⁵ T, if the space occupies an area of 10 x 10⁸ m² and has a height of 750 m.**

Given that

Earth's magnetic field $= B = 7\times 10^{-5} T$

Area $= A = 10\times 10^{8} m^2$

Height above the earth = h = 750 m

Magnetic energy stored $= U_m = ?$

By formula

$$U_m = \frac{1}{2}\frac{B^2}{\mu_o}(Al)$$

But

$$\mu_o = 4\pi\times 10^{-7} Wb/Am$$

$$U_m = \frac{1}{2}\times\frac{(7\times 10^{-5})^2}{4\pi\times 10^{-7}}\times 10\times 10^{8}\times 750$$

$$= 14629.7\times 10^{-10+8+7}$$

$$= 14629.7\times 10^{5}$$

$$U_m = 1.46\times 10^{9} J$$

OBJECTIVES (MCQ'S) OF CHAPTER-16 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Alternating Current:

1.The instantaneous value of current is:
(A) $I_o \sin(2\pi f)$ (B) $I_o \sin(2\pi)$ (C) $I_o \sin(2\pi fL)$ (D) $I_o \sin(2\pi ft)$

2.The most common source of alternating voltage is: (2 Times)
(A) Motor (B) Transformer (C) AC generator (D) All of these

3. If $I_{rms} = 10A$ then I will be equal to:
(A) 14.2A (B) 1.42A (C) 142A (D) 0.142A

4. For an open circuit, the current flowing through circuit will be:
(A) Infinite (B) Finite (C) Maximum (D) Zero

5. If I_o is the peak value of AC supply, then its rms value is given as I_{rms} = ____: (2 times)
(A) $\frac{I_o}{\sqrt{2}}$ (B) $\frac{I_o}{0.707}$ (C) $I_o\sqrt{2}$ (D) $\frac{7N}{8}$

6. The phase at negative peak will be:
(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{3}$ (C) $\frac{3\pi}{2}$ (D) π

7. If V_{rms} are the root mean square value of voltage then peak value of voltage is:
(A) $\sqrt{2}V_{rms}$ (B) $2V_{rms}$ (C) $\frac{V_{rms}}{\sqrt{2}}$ (D) $\frac{\sqrt{2}}{V_{rms}}$

8. If $Vrms = 10\sqrt{2}$ volts, then peak voltage V_o will be:
(A) 10 volts (B) 20 volts (C) 30 volts (D) $10/\sqrt{2}$ volts

9. In AC wave form, negative peak is obtained at the phase angle of:
(A) 90° (B) 120° (C) 270° (D) 360°

10. Main reason for the world wide use of AC is that it can be transmitted to:
(A) Short distance at very low cost (B) Long distance at very high cost
(C) Short distance at very high cost (D) Long distance at very low cost

11. The highest value reached by the voltage or current in one cycle is called:
(A) Peak to peak value (B) Peak value
(C) Instantaneous value (D) Root mean square value

12. The peak value of alternating current is I_o. Its mean square value is:
(A) O (B) $2I_o$ (C) $I_o^2/2$ (D) I_o^2

13. The sum of positive and negative peak values is called: (3 times)
(A) Average value (B) r m s value (C) peak value (D) P- P value

14. The phase angle at +ve positive peak is: (3 times)
(A) $\frac{\pi}{2}$ (B) π (C) $\frac{3\pi}{2}$ (D) 2π

15. During each cycle AC voltage reaches a peak value: (2 Times)
(A) Once (B) Twice (C) Thrice (D) Four times

16. The waveform of alternating voltage is a:
(a)Contangent curve (b) cosine curve (c) Tangent curve (d) sine curve

17. The peak value of A.C source is 20 A, and then its rms value will be:
(a) 14.1 A (b) 10 A (c) 20 A (d) 28.2 A

18. An A.C. Voltmeter reads 220 V, its peak value will be: (2 Times)
(A) 255 V (B) 340 V (C) 311.12V (D)300 V

19. One of the source of an A.C voltage is:
(A) A.C generator (B) Battery (C) UPS (D) Solar cell

20. The sum of positive and negative peak values are usually written as:
(A) P-P value (B) rms values (C) cycle values (D) p-n values

Topic III: A.C through Resistor:

21. The basic circuit element in a D.C circuit is: (2 Times)
(A) Resistor (B) Inductor (C) Capacitor (D) Transistor
22. In an AC circuit with resistor only the current and voltage have a phase of angle of:
(A) 180° (B) 90° (C) 0° (D) 60°
23. In pure resistive AC circuit the instantaneous values of current and voltage are: (2 times)
(A) In phase (B) Perpendicular to each other
(C) Out of phase (D) May or may not be in phase
24. The phase difference between the voltage and current through resistor is: (2 times)
(A) 0° (B) 45° (C) 180° (D) 270°
25. Direct current cannot flow through: (2 times)
(a) Inductor (b) Resistor (c) transistor (d) capacitor

Topic IV: A.C through Capacitor:

26. The phase difference between each pair of coils of a three phase AC generator is:
(A) 0° (B) 90° (C) 120° (D) 180°
27. The reactance Xc of a capacitor C when connected across an AC source of frequency 'f' is given by:
(A) $2\pi fc$ (B) $\frac{1}{2\pi fc}$ (C) $\frac{2\pi f}{c}$ (D) $\frac{c}{2\pi f}$
28. In the capacitive circuit of AC quantity when q = 0 the slope of q-t curve is: (2 times)
(A) Maximum (B) Minimum (C) Zero (D) Negative
29. Capacitor will have a large reactance at:
(A) Low frequency (B) High frequency (C) Zero frequency (D)Negative frequency
30. In capacitor:
(A) Current leads voltage by $\frac{\pi}{2}$ (B) Current lags voltage by $\frac{\pi}{2}$
(C) Current leads the voltage by π (D) Both are in phase
31. The slope of q-t curve at any instant of time gives:
(A) Current (B) Voltage (C) Charge (D) Both A and B
32. The opposition offered by a capacitor to the flow of an A.C is called:
(A) Capacitance (B) Resistance (C) Reactance (D) Inductance
33. At high frequency the value of reactance of capacitor will be: (7 times)
(A) Small (B) zero (C) large (D) infinite
34. In case of capacitor, the unit of reactance is:
(A) Ohm (B) Mho (C) Farad (D) Henry
35. The reactance of capacitor is equal to:
(A) ωc (B) ω/c (C) c/ω (D) $\frac{1}{\omega c}$
36. 100 μF capacitor is connected to an AC voltage of 24 V and frequency 50 Hz. The reactance of the capacitor is:
(A) 30.8 Ω (B) 31.8 Ω (C) 34.8 Ω (D) 40 Ω
37. In pure capacitor AC circuit, the current I and charge q are:
(A) In phase (B) Out of phase (C) Parallel to each other (D) None of above

Topic V: A.C through Inductor:

38. A device that allows only the flow of DC through a circuit is: (4 Times)
(A) Inductor (B) Capacitor (C) AC generator (D) Transformer
39. Inductive reactance of an inductor is:
(A) $X_L = \pi fL$ (B) $X_L = 4\pi fL$ (C) $X_L = 2\pi fL$ (D) $X_L = 2\pi L$
40. Reactance of inductor is very high when there is:
(A) High frequency current (B) Low frequency current
(C) High frequency inductor (D) Low frequency inductor

41. A.C through Inductor, the applied voltage:

(A) Leads the current by $\frac{\lambda}{2}$ (B) lags the current by $\frac{\lambda}{2}$

(C) And Current are in Phase (D) And Current is out of phase 180°

42. The reactance of an inductor is:

(A) ωL (B) $\frac{1}{\omega L}$ (C) $\frac{\omega}{L}$ (D) $\frac{L}{\omega}$

43. The phase difference between current and voltage in an inductive circuit is:

(A) Zero (B) 90° (C) 180° (D) 45°

44. An Inductor of 1 Henry Inductance has a reactance 500 Ohms, then the frequency required is approximately: (2 times)

(A) 50Hz (B) 100Hz (C) 80Hz (D) 120Hz

45. When an inductor comes close to a metallic object, its inductance is:

(A) Decreased (B) Increased (C) Becomes half (D) Becomes 4 times

46. Which consumes small power?

(A) Inductor (B) Resistor (C) Motor (D) All of them

47. The inductiance of a coil can be increased by using.

(A) Air as core metrial (B) Iron as core material

(C) Copper as core material (D) Bismith as core material

48. A device which opposes the flow of A.C. is

(A) resistor (B) capacitor (C) inductor (D) None

Topic VI: Impedance:

49. The impedance Z can be expressed by: (3 Times)

(A) $Z=\frac{V_{rms}}{I_{rms}}$ (B) $Z=\frac{I_{rms}}{V_{rms}}$ (C) Z = I + V (D) Z = I − V

50. SI unit of impedance is: (3 Times)

(A) Henry (B) Hertz (C) Ampere (D) Ohm

51. At resonance frequency the impedance of RLC series circuit is: (2 Times)

(A) Zero (B) Minimum (C) Maximum (D) Moderate

52. When 10V are applied to an A.C circuit, the current flowing in it is 100mA. Its impedance is: (3 times)

(A) 100Ω (B) 10Ω (C) 1000Ω (D) 1Ω

Topic VII: R.C and R.L Series Circuit:

53. When an RC circuit is connected across a battery amount of charge deposited on plates is ____ times the equilibrium charge after one time constant:

(A) 0.63 (B) 0.67 (C) 0.75 (D) 0.86

54. In LC series circuit the phase angle between X_L and X_C is:

(A) $\tan^{-1}\frac{\omega L}{R}$ (B) $\tan^{-1}\frac{\omega}{RL}$ (C) $\tan^{-1}\frac{\omega C}{R}$ (D) π rad

Topic VIII: Power in A.C Circuits:

55. The power factor of an AC series circuit is:

(A) Always greater than one (B) Always less than one

(C) Always equal to one (D) Zero

56. Power dissipation is zero in a circuit of:

(A) Inductor (B) Capacitor (C) Resistor (D) Inductor and capacitor

57. The power dissipated in AC circuit is given by $P=I_{rms}V_{rms}\cos\theta$ in this relation $\cos\theta$ is called: (3Times)

(A) Phase factor (B) Gain factor (C) Loss factor (D) Power factor

58. Power dissipation in a pure inductive or in a pure capacitance circuit is: (3 times)

(A) Infinite (B) Zero (C) Minimum (D) Maximum

59. The power dissipation in AC circuit is expressed as:

(A) $P=I_{rms}\times V_{rms}\cos\theta$ (B) $P=I\times V\cos 2\theta$

(C) $P=I_{rms}\times V_{rms}\sin\theta$ (D) $P=I\times V\sin 2\theta$

60. Power dissipated in pure conductor is:
a) Large (b) small (c) infinite (d) zero

Topic IX: Series Resonance Circuit:

61. In RLC series resonance circuit, at resonance frequency, Impedance 'Z' is: (2 times)
(A) $\sqrt{R^2 + X_l^2}$ (B) R (C) $\sqrt{R^2 + X_c^2}$ (D) X_L

62. At higher frequencies, which of the following plays a dominant role in RLC series circuit:
(A) Resistor (B) Inductor (C) Capacitor (D) Transistor

63. The condition of resonance in R-L-C series circuit is: (4 times)
(A) $X_L = X_C$ (B) $X_L > X_C$ (C) $X_L < X_C$ (D) All of these

64. In R-C-L series circuit, the current at resonance frequency is: (3 times)
(A) Minimum (B) Zero (C) Maximum (D) Infinite

65. Resonating frequency of RLC series circuit of $f_r =$ _____ :
(A) $\frac{2\pi}{\sqrt{LC}}$ (B) $\frac{1}{2\pi}\sqrt{LC}$ (C) $\frac{1}{2\pi\sqrt{LC}}$ (D) $2\pi\sqrt{LC}$

66. At resonance the value of current in RLC series circuit is equal to:
(A) $\frac{V_o}{R}$ (B) $V_o R$ (C) $\frac{1}{2}$ (D) Zero

67. During frequency modulation when amplitude of signal is zero, the frequency of carrier wave is:
(A) Zero (B) Maximum (C) Minimum (D) Normal

68. In RLC series circuit at resonance the phase difference between capacitor and inductor reactances is:
(A) 90° (B) 270° (C) 0° (D) 180°

69. At resonance frequency the impedance of RLC series circuit is: (2 times)
(A) Zero (B) Minimum (C) Maximum (D) Moderate

70. In RLC – series circuit, at resonance frequency X_C and X_L are:
(A) In phase (B) Opposite in phase (C) Differ by a phase $\frac{\pi}{2}$ (D) At angle of 120°

71. If the frequency of AC supplied is doubled then the capacitive reactance becomes:
(A) Half (B) Two times (C) Four Times (D) One Fourth

Topic X: Parallel Resonance Circuit:

72. At resonance frequency, the impedance of RLC — Parallel Circuit is:- (2 times)
(a) Zero (b) Infinite (c) Minimum (d) Maximum

73. In R-L-C circuit, the energy is dissipated in:-
(a) R only (b) R and L (c) R and C (d) R, L and C

Topic XI: Three Phase A.C Supply:

74. Three phae AC supply machine has:
(A) No terminal (B) 2 terminal (C) 4 terminal (D) 6 terminal

75. In three phase voltage across any two lines is about: (2 times)
(a) 220 V (b) 230 V (c) 400 V (d) 430 V

76. In a three phase AC generator the phase difference between each pair of coil is: (3 Times)
(a) 45⁰ (b) 60⁰ (c) 90⁰ (d) 120⁰

Topic XII: Principle of Metal Detector:

77. Metal detector work with the help of:
(A) RC circuit (B) RL circuit (C) LC circuit (D) RLC series circuit

Topic XIII: Choke:

78. Resistance of choke is: (2 times)
(A) Zero (B) Very small (C) Large (D) Infinite

79. In choke of inductance L and resistance R:
(A) L is large and R is small (B) L is small R is large
(C) Both L and R are large (D) Both L and R are small

80. Choke consumes extremely small: **(3 Times)**
(a) Current (b) Charge (c) Power (d) Potential

Topic XIV: Electromagnetic Waves:

81. X-Rays have wavelength of the order of:
(A) 10^{-4}m (B) 10^{-5}m (C) 10^{-10}m (D) 10^{-2}m

82. High frequency radio wave is called: **(3 Times)**
(A) Fluctuated wave (B) Carrier wave (C) Matter wave (D) Energy wave

83. The amplitude modulated transmission waves have frequencies range:
(A) 540 Hz to 1600 Hz (B) 540 kHz to 1600 kHz
(C) 540 Hz to 1600 MHz (D) 88 MHz to 108 MHz

84. Electrons vibration 94,000 times each second will produce radio waves of frequency.
(A) 94Hz (B) 940Hz (C) 940 KHz (D) 94 KHz

85. The frequency range for F.M is given by: **(3 times)**
(A) 88 MHz – 108 MHz (B) 88 KHz – 108 KHz
(C) 540 MHz – 1600 MHz (D) 540 KHz – 1600 KHz

Topic XV: Modulation:

86. The process of combining low frequency signal with a high frequency radio waves is called.
(A) Amplification (B) Resonance (C) Demodulation (D) Modulation

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87. If the frequency of A.C. Supply is doubled then the reactance of the capacitor is:
(a) Half (b) Two times (c) four times (d) one fourth

88. In three phase A.C. supply, if first coil has phase 0^0, then the other two coils will have phases: **(2 times)**
(a) 0^0 to 120^0 (b) 120^0 and 240^0 (c) 240^0 and 360^0 (d) 0^0 and 360^0

89. The unit of $\sqrt{LC}$ is:
(a) second (b) Ampere (c) Hertz (d) Farad

90. At what frequency, 1 H inductance offers same impedance as 1μF capacitor:
(a) 50Hz (b) 159 Hz (c) 512 Hz (d) 1590 Hz

91. Metal detector consists of:
(A) L C circuit (B) R L circuit (C) R C circuit (D) R L C series circuit

92. S.I unit of reactance is: **(2 times)**
(A) Farad (B) Volt (C) Ampere (D) Ohm

93. The device which allows only the continuous flow of AC through it is:
(A) Capacitor (B) Inductor (C) Battery (D) Thermistor

94. The inductive reactance of a coil is directly proportional to:
(A) Inductance (B) Resistance
(C) Frequency of A.C (D) Both Frequency of A.C and Inductance

95. At resonance, the behaviour of R – L – C series circuit is:
(A) Resistive (B) Capacitive (C) Inductive (D) Modulative

96. In metal detectors, we use:
(A) RL circuit (B) RC circuit (C) LC circuit (D) any of these

97. In frequency modulation, which factor is changed:
(A) Amplitude of carrier waves (B) Frequency of carrier wave
(C) Amplitude of signal (D) Frequency of signal

98. If V_0 is the peak value of A.C. voltage, its rms value is:
(A) $V_{rms} = \sqrt{2}V_0$ (B) $V_{rms} = \frac{V_0}{2}$ (C) $V_{rms} = \frac{\sqrt{2}}{V_0}$ (D) $V_{rms} = \frac{V_0}{\sqrt{2}}$

99. The inductive reactance X_L of coil of inductance 'L' across an A.C. source is given by:
(A) $X_L = \frac{1}{2\pi f L}$ (B) $X_L = \frac{2\pi f}{L}$ (C) $X_L = \frac{1}{\pi f L}$ (D) $X_L = 2\pi f L$

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100. When a metal detector comes close to a metal then its frequecy:
(A) becomes double (B) Remains same (C) Becomes half (D) Increases

101. In RLC series circuit, at higher frequencies:
(A) $X_L = X_C$ (B) $X_L > X_C$ (C) $X_L < X_C$ (D) $X_L = 0$

102. Which device permits the flow of D.C?
(A) Capacitor (B) Photocell (C) Inductor (D) Transformer

103. Which of the following waves do not travel at the speed of light:
(A) Radio waves (B)X-rays (C) Sound waves (D) Heat waves

104. When A.C passes through an inductor, voltage leads the current by an angle:
(A) 0° (B) 45° (C) 90° (D) 180°

105. If we connect an ordinary D.C. Ammeter to measure alternating current, it would measure its value as:
(A) Instantaneous Value over a cycle (B) Peak to peak value
(C) Averaged over a cycle (D) r.m.s. value

106. The impedance of R-L series circuit is:
(A) $Z=\sqrt{R^2+X_L^2}$ (B) $Z=\sqrt{R^2+X_C^2}$ (C) $Z=\sqrt{R+X_L}$ (D) $Z=R$

107. The capacitance required to construct a resonance circuit of frequency 1000 kHz with an inductor of 5mH is: **(2 times)**
(A) 5.09 pF (B) 5.09 μF (C) 5.09mF (D) 50.9 pF

108. The peak to peak value is: **(2 times)**
(A) V_0 (B) $-V_0$ (C) $\sqrt{2}V_0$ (D) $2V_0$

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109. The capacitive reactance to a pure D.C is:
(A) Zero (B) Infinite (C) 2 Ohm (D) 3 Ohm

110. At resonance, the impedance of RLC series circuit is:
(A) Zero (B) Minimum (C) Maximum (D) Variable

111. Current leads the applied voltage in pure ________ circuit.
(A) Resistive (B) Capacitive (C) Inductive (D) Reactive

112. In Free Space, the speed of Electromagnetic Waves is:
(A) $332 ms^{-1}$ (B) $3\times10^8 ms^{-1}$ (C) $1.1\times10^3 ms^{-1}$ (D) $2.6\times10^4 ms^{-1}$

113. The unit of $\frac{\omega L}{R}$ in R - L series circuit is
(A) Ohm (B) Volt (C) Henry (D) Unitless

114. For an inductor connected to an A.C. source, the applied voltage:
(A) leads the current (B) is in phase with current
(C) lags the current (D) changes independently

115. In R-L series circuit, phase angle is given by:
(A) $\theta=\tan^{-1}(\omega RL)$ (B) $\theta=\tan^{-1}\left(\frac{R}{\omega L}\right)$
(C) $\theta=\tan^{-1}\left(\frac{\omega L}{R}\right)$ (D) $\theta=\tan^{-1}\left(\frac{1}{\omega RL}\right)$

116. At low frequency the current through a capacitor of A.C. circuit will be:
(A) Large (B) Small (C) Zero (D) Infinite

117. The inductance and capacitance behave a function of:
(A) Voltage (B) Frequency (C) Time (D) Current

118. In an A.C Circuit, a Resistance R is connected in Series with an Inductance L if phase angle between voltage and current be 45°, the value of inductive reactance will be:
(A) 2 R (B) R (C) $\frac{R}{2}$ (D) $\frac{R}{4}$

119. An A.C varies a function of :
(A) Time (B) Current (C) Voltage (D) Displacement

120. At high frequency the current through a capacitor of A.C. Circuit will be:
(A) Large (B) Small (C) Infinite (D) Zero

121. With increase in frequency of an A.C. supply, the impedance of RLC series circuit:
(A) Decreases (B) Increases
(C) Remains constant (D) 1st decrease become minimum

ANSWERS OF THE MULTIPLE CHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
D	C	A	D	A	C	A	B	C	D	B	C	D	A	B	D
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
A	C	A	A	A	C	A	A	D	C	B	A	A	A	A	C
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
A	A	D	B	B	A	C	A	A	A	B	C	A	A	B	C
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
A	D	B	A	A	D	C	D	D	B	A	D	B	B	A	C
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
C	A	D	D	B	B	A	D	A	C	C	D	C	B	A	C
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
C	B	B	D	A	D	A	B	A	B	A	D	A	D	A	C
97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112
B	D	D	D	B	C	C	C	C	A	A	D	B	B	B	B
113	114	115	116	117	118	119	120	121							
D	A	C	B	B	A	A	A	D							

SHORT QUESTIONS OF CHAPTER-16 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Alternating Current:

1. A sinusoidal current has rms value of 10A. What is the maximum or peak value? **(22 Times)**

Ans: It is given that

$$I_{rms} = 10\ A$$
$$I_0 = ?$$

Since

$$I_{rms} = \frac{I_0}{\sqrt{2}}$$
$$I_0 = \sqrt{2} I_{rms}$$
$$I_0 = 1.414 \times 10$$
$$I_0 = 14.14\ A$$

2. Differentiate between peak value and peak to peak value. **(4 Times)**

Ans: <u>Peak value:</u> It is the highest value reached by the voltage or current in one cycle. It is denoted by the V_0.

<u>Peak to peak value:</u> It is the sum of the positive and negative peak values usually written as p-p value.

3. In relation $V = V_0 \sin\theta$. What angle θ shows?

Ans: In $V = V_0 \sin\theta$

Here $\theta = \omega t$

It specifies the instantaneous value of the alternating voltage or current known as its phase.

4. Find the peak value of the voltage V_0 of an AC supply for which root mean square voltage is 0.7 V.

Ans: Given that

$$V_{rms} = 0.7\ V$$
$$V_o = ?$$

Since

$$V_{rms} = \frac{V_o}{\sqrt{2}}$$
$$V_o = \sqrt{2} V_{rms}$$
$$V_o = \sqrt{2}(0.7)$$

$$V_o = 0.989\ V \approx 1\ V$$

5. What is the root mean square value of current? Explain. **(2 times)**

Ans: The square root of mean square values of current is called root mean square (rms) value of current.

$$I_{rms} = \frac{I_0}{\sqrt{2}}$$

The average value of current over a cycle is zero but the power delivered during a cycle is not zero because power is I^2R and the values of I^2 are positive even for negative values of I.

6. Define Instantaneous Value and Peak Value of Current. **(3 times)**

Ans: The value of current or voltage at any instant is called instantaneous value and the maximum value of current or voltage is called peak value.

7. Define peak to peak value of A.C. voltage.

Ans: It is the sum of the positive and negative peak values. If V_o is the peak value of the voltage waveform then p-p value is $2V_o$.

8. Define phase of alternating voltage. OR Explain the term phase of AC. **(3 times)**

Ans: The angle $\theta = \omega t$ which specifies the instantaneous value of the alternating voltage or current is known as its phase.

9. How many times per second will an incandescent lamp reach maximum brilliance when connected to a 50 Hz source? Explain. **(14 Times)**

Ans: An incandescent lamp will reach maximum brilliance two times in a cycle. One time for positive half cycle and one for negative half cycle.

So, the maximum brilliance per second will be

$$2f = 2 \times 50 = 100 \text{ times}$$

10. What is the difference between A.C circuit and D.C circuit?

Ans: In A.C circuit, in addition to resistor R, inductor and capacitor are used to control the current and voltage.

In D.C circuit, resistor R is used to control the current and voltage.

11. What is the main reason for the world-wide use of A.C.?

Ans: Because it can be transmitted to long distances easily and at a very low cost. Its power losses are very small and it may step up or step down by means of a transformer.

12. An AC voltmeter reads 250V. What is its peak value? **(2 Time)**

Ans: Given that $V_{rms} = 250V$, $V_0 = ?$.

We know that

$$V_{rms} = \frac{V_0}{\sqrt{2}}$$

$$V_0 = V_{rms}\sqrt{2} = \sqrt{2} \times 250V = 353.5V$$

13. An alternating current is represented by equation I = 20 Sin100πt. Compute its frequency and rms value of current.

Ans: $I = 20 \sin 100\pi t$ ______________(i)

$f = ?$

$I_{rms} = ?$

An alternating current is given by

$I = I_0 \sin 2\pi ft$ ______________(ii)

Comparing equation (i) and (ii)

$I_0 = 20A$

& $2\pi ft = 100\pi t$

⇨ $2f = 100$ $f = 50Hz$

We know that

$$I_{rms} = \frac{I_0}{\sqrt{2}} = \frac{20}{\sqrt{2}} = 14A$$

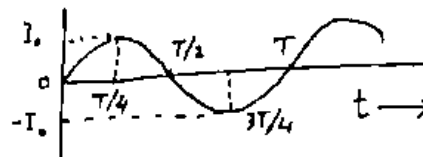
14. What do you mean by phase lag and phase lead? **(2 Time)**

Ans: The angle θ which specifies the instantaneous value of the alternative voltage or current, gives the phase lag or phase lead of one quantity over the other. The phase difference between two alternative quantities is observed at different

points. The quantity which has greater phase at all points is said to be leading and the other is said to be lagging behind.

15. Define A.C current. Make its waveform.

Ans: A.C is that which is produced by a voltage source whose polarity keeps on reversing with time.

16. A sinusoidal current has rms value of 15A. What is the maximum value?

Ans: As $I_{rms} = \frac{I_0}{\sqrt{2}}$

Or $I_0 = \sqrt{2}\, I_{rms}$

$I_0 = \sqrt{2} \times 15 = 21.21\,A$

Topic III: A.C through Resistor:

17. Define reactance. Describe the condition which will make the reactance small.

Ans: The opposition offered by capacitor or inductor to the flow of alternating current is called reactance.

For a capacitor reactance will be small when frequency is large and for an inductor reactance will be small when frequency is small.

Topic IV: A.C through Capacitor:

18. How does doubling the frequency affect the reactance of an inductor and a capacitor? **(28 Time)**

Ans: For inductor $X_L = \omega L = 2\pi f L$

By doubling the frequency

$$X_L' = 2\pi(2f)L = 2(2\pi f L)$$
$$X_L' = 2X_L$$

That is, inductive Reactance will be doubled.

and for capacitor $X_C = \frac{1}{\omega C} = \frac{1}{2\pi f C}$

By doubling the frequency

$$X_C' = \frac{1}{2\pi(2f)C} = \frac{1}{2(2\pi f C)}$$
$$X_C' = \frac{1}{2} X_C$$

That is, capacitive Reactance will be halved.

19. Name the device that will: **(11 times)**

a) Permit flow of direct current but oppose the flow of alternating current.

b) Permit flow of alternating current but not the direct current.

a) **Ans:** An inductor is a device which permits flow of direct current but opposes the flow of alternating current.

b) A capacitor is a device which permits flow of alternating current but not the direct current.

20. What is meant by inductive and capacitive reactance? **(3 Times)**

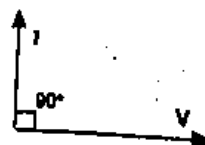
Ans: The measure of opposition offered by the inductor to the flow of alternating current is called inductive reactance. $X_L = \omega L$ And

The measure of opposition offered by the capacitor to the flow of alternating current is called capacitive reactance.

$$X_C = \frac{1}{\omega C}$$

21. Which quantity, voltage or current leads in a capacitor and by how much angle?

Ans: Current leads the voltage in a capacitor by 90° or $\frac{\pi}{2}$.

Vectorially

22. Define reactance of a Capacitor. Also write down its formula.

Ans: The opposition offered by a capacitor in the flow of A.C is called capacitive reactance. It varies inversely with the frequency of A.C. i.e.

$$X_C = \frac{1}{2\pi fC}$$

Topic V: A.C through Inductor:

23. At what frequency will an inductor of 1.0H have a reactance of 500Ω ?(4 Times)

Ans: Given that

$$L = 1\,H$$
$$X_L = 500\,\Omega$$
$$f = ?$$

Since

$$X_L = \omega L$$
$$X_L = 2\pi f L$$
$$f = \frac{X_L}{2\pi L}$$
$$f = \frac{(500)}{2(3.14)(1)}$$
$$f = 80\,Hz$$

24. Define reactance of an inductor and write its formula.

Ans: The opposition offered by an inductor in the flow of AC is called inductive reactance which varies directly with frequency of AC. i.e. $X_L = 2\pi fL$

25. Why is power dissipated zero in pure inductive and pure capacitive circuit?

Ans: We know that in pure inductive circuit, voltage is leading 90° from current.
In pure capacitive circuit, current is leading by 90° from voltage.
In both the cases, the phase difference between current and voltage is 90°.
Therefore, power dissipated is zero.

As $P = V\,I\cos\theta$

So, $P = V\,I\cos 90° = V\,I\,(0) = 0$

26. A circuit contains an iron – cored inductor, a switch and a D.C source arranged in series. The switch is closed and after an interval reopened. Explain why a spark jumps across the switch contacts. (5 Times)

Ans: When switch is closed then circuit completes, current increases from zero to I and steady current flows through inductor.
When switch is reopened, the circuit will be open, and current suddenly decreases from I to zero.
According to Lenz's law "the direction of induced current is always so as to oppose the change which produced it". Thus when current decreases, induced current reinforce it and sparks are produced due to large value of current.

Topic VI: Impedance:

27. Define impedance and resonant frequency.

Ans: A measure of the opposition to the flow of charges in an AC circuit is called impedance. It is the combined effect of resistance and inductive and capacitive reactance's.

$$Z = \frac{V_{rms}}{I_{rms}}$$

Its unit is Ohm (Ω).
And
The frequency at which inductive and capacitive reactance become equal is called resonant frequency.

$$f_R = \frac{1}{2\pi\sqrt{LC}}$$

28. Define impedance, also give its units. (7 times)
OR
Define impedance write down its unit and symbol.

Ans: The combined effect of resistances and reactance's in an AC circuit is known as impedance. It is denoted by 'Z' and its SI unit is ohm (Ω).

29. What is impedance? Write its formula.

Ans: The combined effect of resistances and reactances in an AC circuit is called impedance. It is denoted by "Z".

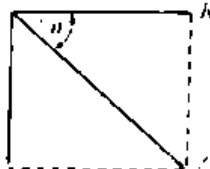
It is measured by the ratio of the rms value of the applied voltage to the rms value of resulting AC.

Thus $$Z = \frac{V_{rms}}{I_{rms}}$$

Topic VII: R.C and R.L Series Circuit:

30. Show that for RC circuit, the angle between current and voltage is given as

$$\theta = \tan^{-1}\left(\frac{1}{\omega RC}\right)$$

Ans: Vector representation of V & I for RC series circuit is given as

From figure,

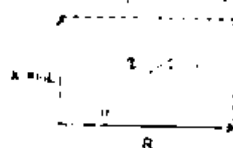
$$\tan\theta = \frac{X_C}{R}$$

$$\tan\theta = \frac{1}{\omega CR}$$

$$\theta = \tan^{-1}\left(\frac{1}{\omega RC}\right)$$

31. In a RL circuit, will the current lag or lead the voltage? Illustrate your answer by vector diagram. (12 Times)

Ans: In an RL circuit, current lags the voltage by an angle

$$\theta = \tan^{-1}\left(\frac{\omega L}{R}\right)$$

32. Define impedance and write the impedance expression for R – L series circuits.

Ans: The combined effect of resistance and reactances in an AC circuit is known as impedance and is denoted by Z.

Impedance of R – L series circuit is given by

$$Z = \sqrt{R^2 + (\omega L)^2}$$

Topic VIII: Power in A.C Circuits:

33. How power is calculated in an A.C circuit? Write its formula.

Ans: The power dissipated in A.C circuits is calculated by using the formula

$$P = I_{rms} V_{rms} \cos\theta$$

Where θ is the phase difference between I_{rms} & V_{rms} and cosθ is the power factor.

34. How can you establish the formula for power in A.C circuits? Explain the role of power factor in it.

Ans: When V and I are in phase, the expression for power is

$$P = V_{rms} I_{rms}$$

In A.C circuits the phase difference between applied voltage V and current I_{rms} is θ. The component of V along current I_{rms} is $V_{rms}\cos\theta$. So the power dissipated in A.C circuit is

$$P = I_{rms} V_{rms} \cos\theta$$

The factor cosθ is known as power factor. For resistive circuits power factor is one.

Topic IX: Series Resonance Circuit:

35. Write three characteristics of series resonance circuit.

Ans: The resonance frequency is given

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

The impedance of the circuit is minimum at resonance frequency and the current is maximum.
The impedance of the circuit at resonance is resistive so the current and the voltage are in phase and power factor is 1.

36. At resonance frequency the impedance of RLC series circuit is only resistive. Why?

Ans: At resonance frequency, the inductive reactance becomes equal and opposite to capacitive reactance and cancels each other. So the impedance of RLC circuit is only resistive.

37. Prove that $f_r = \frac{1}{2\pi\sqrt{LC}}$.

Ans: As at resonance condition

$$X_L = X_C$$

$$\omega_r L = \frac{1}{\omega_r}$$

$$\omega_r^2 = \frac{1}{LC}$$

$$\omega_r = \frac{1}{\sqrt{LC}}$$

$$2\pi f_r = \frac{1}{2\pi\sqrt{LC}}$$

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

Hence proved.

38. Write two properties of RLC series circuit.

OR Write two properties of series resonance circuit. (2 times)

Ans: 1. The impedance of the circuit at resonance is minimum and equal to R.
2. The power factor of RLC series circuit is 1.
3. The resonance frequency is given

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

39. Show that potential difference across LC is zero at resonating frequency in series LRC series circuit.

Ans: At resonance frequency

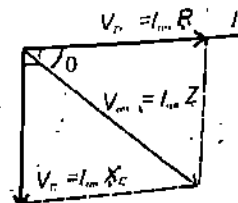
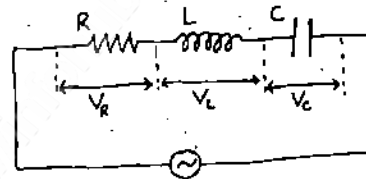
$X_L = X_C$

Or $IX_L = IX_C$

Or $V_L = V_C$

In inductor voltage V_L leads the current and in capacitor voltage V_C lags behind the current. Phase difference between V_L and V_C is 180^0. Therefore, V_L and V_C being equal in magnitude cancels each other.

40. In R-C series circuit, will the current lag or lead the voltage. Illustrate your answer by a vector diagram.

Ans: In R-C series circuit current leads the voltage by an angle "θ" as shown in figure below.

The phase difference "θ" is given as

$$\theta = \tan^{-1}\left(\frac{V_c}{V_r}\right) = \tan^{-1}\left(\frac{1}{\omega CR}\right)$$

Topic X: Parallel Resonance Circuit:

41. Give any two properties of parallel resonant circuit. **(3 Times)**

Ans: At resonance frequency, the circuit impedance is maximum.
At resonance, the circuit current is minimum and is in phase with the applied voltage.

Topic XI: Three Phase A.C Supply:

42. Write down two advantages or uses of three phase AC supply. **(6 Time)**

Ans: i. The main advantage of having a three phase supply is that the total load of the house or a factory is divided in three parts, so that none of the line is overloaded.

iii. Three phase supply also provides 400 V which can be used to operate some special appliances which require 400 V for their operation.

Topic XII: Principle of Metal Detector:

43. Explain the principle of metal detector.

Ans: Difference of frequencies of two LC oscillator circuits caused by placing the metallic object near one of them results to produce the beats.

44. What is the principle of metal detector? Write two uses of metal detector.

Ans: In metal detectors, two electric (L – C) oscillators A and B having same resonance frequency are used. When inductor B, called the search coil comes near a metal object, its inductance decreases and corresponding oscillator frequency increases and thus a beat note is heard in the attached speaker.

(i) It is used for various security checks.
(ii) It is used to locate buried metal objects.

Topic XIII: Choke:

45. A choke coil placed in series with an electric lamp in AC circuit, the lamp to become dim, why is it so? **(2 Times)**

Ans: When there is no inductance or capacitance in the circuit then

$$Z = R$$

So $$I_1 = \frac{V}{R}$$

And when choke coil is in series with an electric lamp then

$$Z = \sqrt{R^2 + X_L^2}$$

So $$I_2 = \frac{V}{\sqrt{R^2 + X_L^2}}$$

On comparison, it can be seen that $I_2 < I_1$

Thus an electric lamp is dimmed on placing a choke coil in the circuit.

46. What is choke? **(4 Times)**

Ans: It is a coil of thick copper wire wound closely over a soft iron laminated cores. It is used in AC circuits to limit current with extremely small wastage of energy as compared to a resistance or a rheostat.

47. What is choke? Why is it used in AC circuit? **(3 Times)**

Ans: A choke is a coil made of thick insulated copper wire wound closely in a large number of turns over a soft iron laminated core. It is used to control alternating current through a circuit without much loss of energy.

48. Define alternating current and choke.

Ans: **Alternating current** is that which is produced by a voltage source whose polarity keeps on reversing with time.

$$I = I_0 \sin 2\pi f t$$

Choke is a coil which consists of thick copper wire wound closely in a large number of turns over a soft iron laminated core. Its resistance is very small. It consumes extremely small power.

49. Define choke and impedance.

Ans: **Choke** is a coil which consists of thick copper wire wound closely in a large number of turns over a soft iron laminated cores. It consumes extremely small power.

The combined effect of resistances and reactances in an A.C circuit is called **Impedance**.

$$Z = \frac{V_{rms}}{I_{rms}}$$

Topic XIV: Electromagnetic Waves:

50. Write the conditions under which electromagnetic waves are produced from a source? (8 Times)

Ans: Electromagnetic waves are produced according to the following
"A changing magnetic flux creates an electric field and a changing electric flux creates magnetic field."

51. Define choke and electromagnetic waves.

Ans: **Choke** is a coil which consists of thick copper wire wound closely in a large number of turns over a soft Iron laminated cores. It consumes extremely small power.
Electromagnetic waves are those which require no medium for transmission and rapidly propagate through vacuum. e.g. visible light, x-rays, gamma rays etc.

Topic XVI: Modulation:

52. What is modulation? Name its types. (2 times)
OR Define modulation and write its types.

Ans: The process of combining the low frequency signal with a high frequency is called modulation.
It is of two types.
i. Amplitude modulation (AM) ii. Frequency modulation (FM)

53. What is meant by A.M and F.M? Also give their range. (12 Times)
OR Differentiate between A.M and F.M. OR What is meant by A.M and F.M? (4 Times)

Ans: **Amplitude Modulation (A.M)**
It is that type of modulation in which the amplitude of the carrier wave is increased or decreased as the amplitude of the superposing modulating signal increases or decreases. The AM transmission frequencies range from 540 kHz to 1600 kHz.
Frequency Modulation (F.M)
It is that type of modulation in which the frequency of the carrier wave is increased or decreased as the amplitude of the superposing modulating signal increases or decreases but the amplitude of carrier wave remains constant. The FM transmission frequencies range from 88 MHz to 108 MHz.

54. Write down advantages and disadvantages of FM and AM. (2 Times)

Ans: Advantages
i. FM transmission frequencies are much higher and ranges between 88 MHz to 108 MHz. AM transmission frequencies range from 540 kHz to 1600 kHz.
ii. FM radio waves are affected less by electrical interference than AM radio waves.

Disadvantages
i. FM have a shorter range than AM.
ii. FM are less able to travel around obstacles such as hills and large buildings.

Topic XV: Principle of Generation:

55. How the reception of a particular radio station is selected on your radio set? (8 Time)

Ans: A particular radio station can be selected on a radio set by tuning it. When the frequency of the LC oscillator in the radio set is equal to the frequency of the radio wave from a particular radio station, a resonance is produced.

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

The current of this signal becomes maximum and can be detected and amplified.

56. What is the principle of generation of electromagnetic waves.

Ans: According to Maxwell's equations:
"A changing magnetic flux creates an electric field and changing electric flux creates a magnetic field."
Electromagnetic waves are generated when electric or magnetic flux is changing through a certain region of space.

2021

57. At frequency of 80 Hz, the reactance of inductor is 500Ω. What will be the Inductance?

Ans: Given that

$$f = 80\ Hz$$
$$X_L = 500\ \Omega$$
$$L = ?$$
$$X_L = \omega L$$

Since

$$X_L = 2\pi f L$$
$$L = \frac{X_L}{2\pi f}$$
$$f = \frac{(500)}{2(3.14)(80)}$$
$$L = 1\ H$$

58. Explain power dissipation in an Inductor.

Ans: No power is dissipated in a pure inductor. In first quarter of cycle both V and I are positive so power is positive which means the ehergy is supplied to inductor. In the second quarter V is -ve but I is +ve so the power is negative and energy is returned by the inductor. Again in third quarter, it receiving energy but returns the same amount in fourth quarter. In this way no net change of energy is observed in a cycle. Since an inductor coil does not consume energy the coil is used for controlling AC without consumption of energy, such as inductance coil is known as choke.

59. What are the electromagnetic waves?

Ans: The waves which don't require any material medium for their propagation are called electromagnetic waves. It consists of vibrating electric and magnetic fields which move at the speed of light and are at right angle to each other and to the direction of propagation.

60. A 100 μF is connected to an alternating voltage of 24V and frequency 50 Hz. Calculate the current in the circuit.

Ans: Given that

$C = 100\mu F = 100 \times 10^{-6} F$

$V_{rms} = 24V$

$f = 50Hz$

$I_{rms} = ?$

Reactance of capacitor $X_C = \frac{1}{2\pi f C}$

$$X_C = \frac{1}{2\times 3.14\times 50\times 100\times 10^{-6}} = 31.8\Omega$$

As we know that

$$I_{rms} = \frac{V_{rms}}{X_c}$$
$$= \frac{24}{31.8} = 0.75A$$

61. Write four properties of parallel resonant circuit.

Ans: i. The resonance frequency is given

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

ii. At resonance frequency, the circuit impedance is maximum.

iii. At resonance, the circuit current is minimum and is in phase with the applied voltage.

iv. At resonance, the branch current I_L, and I_C may each be larger than the source current I_r.

2nd year

62. When 10 V are applied to an A.C. circuit, the current flowing in it is 100 mA. Find its impedance.

Solution:

rms value of applied voltage $= V_{rms} = 10V$

rms value of current $I_{rms} = 100mA = 100\times10^{-3}A$

Impedance $Z = \frac{V_{rms}}{I_{rms}} = \frac{10V}{100\times10^{-3}A} = 100\Omega$

63. Why the choke is used in AC circuit?

Ans: A choke is a coil made of thick insulated copper wire wound closely in a large number of turns over a soft iron laminated core. It is used to control alternating current through an AC circuit without much loss of energy.

LONG QUESTIONS OF CHAPTER-16 IN ALL PUNJAB BOARDS 2011-2021

Topic III: A.C through Resistor:

1. Explain A.C. through resistor in detail.

Topic IV: A.C through Capacitor:

2. Explain phase relationship between voltage and current when an AC source is connected across a capacitor. Also derive the relation for reactance of a capacitor.

Topic V: A.C through Inductor:

3. Discuss the working of an inductor by A.C source. Find its reactance.
4. Explain the behaviour of A.C through an inductor. Also show that the reactance of a coil depends upon the frequency of the A.C. and inductance L. **(3 times)**

Topic VI: Impedance:

5. What is impedance? Describe series resonance circuit and give its two results.
6. Define impedance and derive a relation for impedance and phase angle for RL and RC series circuit.

Topic VII: R.C and R.L Series Circuit:

7. What is RC series circuit? Derive an expression for impedance and phase angle of RC series circuit. **(5 Times)**
8. Describe the behaviour of RC and RL series circuits with an A.C source. Calculate the impedance of both the circuits by drawing their impedance diagram.
9. What is the behavior of A.C. in R-C and R-L series circuit, also find their impedances.

Topic IX: Series Resonance Circuit:

10. Discuss R-L-C series feeding by A.C source. Find out its resonance frequency.
11. Describe RLC Series Circuit and derive the relation for resonance frequency and write down at least two of its properties. **(3 times)**
12. Describe an R-L-C series circuit. Draw its impedance diagram and derive expression for its resonance frequency. Also write down its properties. **(2 times)**
13. Describe series resonance circuit. Find formula for resonance frequency and write its properties. **(2 times)**
14. Draw the circuit diagram of (R-L-C) series resonance circuit. Discuss its behavior for A.C and also write down its properties. **(4 Times)**
15. Describe series resonance circuit. Find formula for resonance frequency and write its properties.

Topic XIV: Electromagnetic Waves:

16. What are electromagnetic waves? Discuss principle of generation, transmission and reception of electromagnetic waves. **(5 Times)**

Topic XVI: Modulation:

17. Explain what do you mean by modulation. Describe its two types. **(2 Times)**

Topic XV: Principle of Generation:

18. Describe the generation, propagation and reception of electromagnetic waves.

NUMERICAL PROBLEMS OF CHAPTER-16 IN ALL PUNJAB BOARDS 2011-2021

Topic IV: A.C through Capacitor:

1. Find the capacitance required to construct a resonance circuit of frequency 1000 kHz with an inductor of 5 mH. (4 Times)

Ans: Given that $resonance\ frequency = f_r = 1000\ kHz = 10^6\ Hz$

$$self\ inductance = L = 5\ mH = 5 \times 10^{-3}\ H$$

$$capacitance = C = ?$$

Since $f_r = \frac{1}{2\pi\sqrt{LC}}$

$$f_r^2 = \frac{1}{4\pi^2 LC}$$

$$C = \frac{1}{4\pi^2 L f_r^2}$$

$$C = \frac{1}{4(3.14)^2(5 \times 10^{-3})(10^6)^2}$$

$$C = 5.09 \times 10^{-12}\ F = 5.09\ pF$$

2. A 100 μF capacitor is connected to an alternating voltage of 24 V and frequency 50 Hz. Calculate (4 Times)

(a) The reactance of the capacitor

(b) The current in the circuit

Ans: Given that $C = 100\ \mu F = 100 \times 10^{-6}\ F$

$$V = 24\ V$$

$$f = 50\ Hz$$

$$X_C = ?$$

$$I_{rms} = ?$$

(a) The reactance of the capacitor

Since $X_C = \frac{1}{\omega C}$ $\quad X_C = \frac{1}{2\pi f C}$

$$X_C = \frac{1}{2 \times 3.14 \times 50 \times 100 \times 10^{-6}} = 31.8\ \Omega$$

(b) The current in the circuit

Since $X_C = \frac{V_{rms}}{I_{rms}}$ $\quad I_{rms} = \frac{V_{rms}}{X_C}$

$$I_{rms} = \frac{24}{31.8} = 0.75\ A$$

3. Find the value of current flowing through a capacitance 0.5 μF when connected to source of 150 V at 50 Hz. (5 times)

Ans: Given that $C = 0.5\ \mu F = 0.5 \times 10^{-6}\ F$

$$V = 150\ V$$

$$f = 50\ Hz$$

$$I_{rms} = ?$$

Since $X_C = \frac{1}{\omega C}$ $\quad X_C = \frac{1}{2\pi f C}$

$$X_C = \frac{1}{2 \times 3.14 \times 50 \times 0.5 \times 10^{-6}}$$

$$X_C = 6369.4\ \Omega$$

Now $X_C = \frac{V_{rms}}{I_{rms}}$ $\quad I_{rms} = \frac{V_{rms}}{X_C}$

$$I_{rms} = \frac{150}{6369.4} = 0.024\ A$$

Topic V: A.C through Inductor:

4. A circuit has an inductance of $^1/_\pi$ H and resistance of 2000 Ω. A 50 Hz A.C is supplied to it. Calculate the reactance and impedance offered by the circuit. (2 times)

Ans: Given that $L = \frac{1}{\pi}\ H$

$R = 2000\,\Omega$
$f = 50\,Hz$
$X_L = ?$
$Z = ?$

Since $X_L = \omega L$

$$X_L = 2\pi f L$$
$$X_L = 2\pi \times 50 \times \frac{1}{\pi}$$
$$\boxed{X_L = 100\,\Omega}$$

And $Z = \sqrt{R^2 + X_L^2}$

$$Z = \sqrt{(2000)^2 + (100)^2} \boxed{= 2002.5\,\Omega}$$

5. At what frequency will an inductor of $1.0\,H$ have a reactance of $500\,\Omega$? (3 times)

Ans: Given that
$L = 1.0\,H$
$X_L = 500\,\Omega$
$f = ?$

Since $X_L = \omega L$

$$X_L = 2\pi f L$$
$$f = \frac{X_L}{2\pi L}$$
$$f = \frac{500}{2 \times 3.14 \times 1.0} \boxed{= 80\,Hz}$$

6. Find the value of the current and inductive reactance when AC voltage of $220\,volt$ at $50Hz$ is passed through an inductor of $10H$. (8 Time)

Ans: Given that $V = V_{rms} = 220\,V,\ L = 10\,H,\ f = 50\,Hz$
$I = ?$
$X_L = ?$

Since $X_L = \omega L$

$$X_L = 2\pi f L$$
$$X_L = 2(3.14)(50)(10)$$
$$\boxed{X_L = 3140\,\Omega}$$

And
$$X_L = \frac{V_{rms}}{I_{rms}}$$
$$I_{rms} = \frac{V_{rms}}{X_L}$$
$$I_{rms} = \frac{220}{3140}$$
$$\boxed{I_{rms} = 0.07\,A}$$

Topic VIII: Power in A.C Circuits:

7. **A 10 mH, 20 Ω coil is connected across 240 V and $\frac{180}{\pi}$ Hz source. How much power does it dissipate?** (9 times)

Ans: Given that,

$L = 10\,mH$
$R = 20\,\Omega$
$V_{rms} = 240\,V$
$f = \frac{180}{\pi}\,Hz$
Power $= P = ?$

We know that,

$$\text{Power} = P = V_{rms} \times I_{rms} \cos\theta$$

First we have to calculate I_{rms} and θ, as

$$Z = \sqrt{R^2 + X_L^2}$$

Where, $X_L = 2\pi f L$

$$X_L = 2\pi \times \frac{180}{\pi} \times 10 \times 10^{-3}$$

$$X_L = 3.6\,\Omega$$

Now

$$Z = \sqrt{(20)^2 + (3.6)^2}$$

$$Z = \sqrt{400 + 12.96}$$

$$Z = \sqrt{412.96}$$

$$Z = 20.32\,\Omega$$

For calculating I_{rms}

$$Z = \frac{V_{rms}}{I_{rms}}$$

$$I_{rms} = \frac{V_{rms}}{Z}$$

$$I_{rms} = \frac{240}{20.32}$$

$$I_{rms} = 11.81\text{ A}$$

For calculating θ in RL series circuit,

$$\theta = \tan^{-1}\left(\frac{X_L}{R}\right)$$

$$\theta = \tan^{-1}\left(\frac{3.6}{20.3}\right)$$

$$\theta = 10.2^\circ$$

Now power dissipation is,

$$P = V_{rms} \times I_{rms} \cos\theta$$

Putting the values we get,

$$P = 240 \times 11.81 \times \cos 10.2^\circ$$

$$= 240 \times 11.81 \times 0.98$$

$$\boxed{P = 2778\text{ W}}$$

Topic IX. Series Resonance Circuit:

8. An inductor of inductance $150\,\mu H$ is connected in parallel with a variable capacitor whose capacitance can be changed from $500\,pF$ to $20\,pF$. Calculate the maximum frequency and minimum frequency for which the circuit can be tuned.

Ans: Given that

$$L = 150\,\mu H = 150 \times 10^{-6}\,H$$

$$C_1 = 500\,pF = 500 \times 10^{-12}\,F$$

$$C_2 = 20\,pF = 20 \times 10^{-12}\,F$$

$$maximum\ frequency = f_{max} = ?$$

$$minimum\ frequency = f_{min} = ?$$

Since $f = \frac{1}{2\pi\sqrt{LC}}$

$$f \propto \frac{1}{\sqrt{C}}$$

So $f_{min} = \frac{1}{2\pi\sqrt{LC_1}}$

$$f_{min} = \frac{1}{2 \times 3.14 \times \sqrt{150 \times 10^{-6} \times 500 \times 10^{-12}}}$$

$$f_{min} = 0.58 \times 10^6\ Hz$$

$$\boxed{f_{min} = 0.58\ MHz}$$

and $f_{max} = \frac{1}{2\pi\sqrt{LC_2}}$

$$f_{max} = \frac{1}{2 \times 3.14 \times \sqrt{150 \times 10^{-6} \times 20 \times 10^{-12}}}$$

$$f_{max} = 2.91 \times 10^6\ Hz \boxed{= 2.91\ MHz}$$

2nd year

9. What is the resonance frequency of the circuit, which includes a coil of inductance 2.5 H and a capacitance 40 μF? **(6 Times)**

Ans: Given that $L = 2.5\ H$

$$C = 40\ \mu F = 40 \times 10^{-6}\ F$$

$$resonance\ frequency = f_r = ?$$

Since $$f_r = \frac{1}{2\pi\sqrt{LC}}$$

$$f_r = \frac{1}{2(3.14)\sqrt{2.5 \times 40 \times 10^{-6}}} \boxed{= 15.9\ Hz}$$

Topic XI: Three Phase A.c Supply:

10. An alternating source of emf 12 V and frequency 50 Hz is applied to a capacitor of capacitance 3 μ F in series with a resistor of resistance 1 $k\Omega$. Calculate the phase angle. **(3 times)**

Sol: As $V = 12\ volts$, $f = 50\ Hz$

$$C = 3\mu F = 3\times10^{-6} F$$

$$R = 1K\Omega = 1000\Omega$$

$$\theta = ?$$

$$X_C = \frac{1}{2\pi fC}$$

$$X_C = \frac{1}{2\times3.14\times50\times3\times10^{-6}} = \frac{1}{942}\times10^6 = 1.061\times10^{-3}\times10^6$$

$$X_C = 1.061\times10^3 = 1061\ \Omega$$

$$\theta = \tan^{-1}\left(\frac{X_C}{R}\right)$$

$$\theta = \tan^{-1}\left(\frac{1061}{1000}\right) = 46.7^\circ$$

2021

11. An iron core coil of 2.0 H and 50 ohm is placed in series with a resistance of 450 ohm. An A.C. supply of 100 V, 50 Hz is connected across the circuit. Find (i) the current flowing in the coil, (ii) phase angle between the current and voltage.

Solution:

Resistance $= R = 50\Omega + 450\Omega = 500\Omega$

Inductance $= L = 2.0\ H$

Supply voltage $= V_{rms} = 100V$

Frequency $= f = 50\ Hz$

The reactance $= X_L = \omega L = 2\pi fL$

$$= 2\times3.14\times50 s^{-1}\times2.0 H = 628\Omega$$

Impedance $= Z = \sqrt{R^2 + (\omega L)^2} = \sqrt{(500\Omega)^2 + (628\Omega)^2} = 803\Omega$

Current $I_{rms} = \frac{V_{rms}}{Z} = \frac{100V}{803\Omega} = 0.01245A = 12.45mA$

Phase difference $\theta = \tan^{-1}\left(\frac{\omega L}{R}\right)$

$$\theta = \tan^{-1}\left(\frac{628\Omega}{500\Omega}\right) = 51.5^\circ$$

OBJECTIVES (MCQ'S) OF CHAPTER-17 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Classification of Solids:

1. The crystalline structure of NaCl is:
(A) Cubical (B) Hexagonal (C) Triangonal (D) Tetragonal

2. A solid having regular arrangment of molecules throughout its structure is called.
(A) Amorphous solid (B) Polymeric solid
(C) Glassy solid (D) Crystalline solid

3. Example of ductile substance is:.
(A) Glass (B) Wood (C) Lead (D) Oxygen

4. Which one is not a Ductile material:
(A) Lead (B) Steel (C) Copper (D) Wrough Iron

Topic II: Mechanical Properties of Solids:

5.Reciprocal of bulk modulus is:
(A) Elasticity (B) Young modulus (C) Compressibility (D) Shear modulus

6.Best hard magnetic material is made up of:
(A) AlnicoV (B) Iron (C) Nickel (D) Cobalt

7.The SI unit of strain is:
(A) Nm (B) Nm^{-2} (C) No unit (D) $Kgms^{-2}$

8. Nm^{-2} is also celled:
(A) Telsa (B) Weber (C) Pascal (D) Gauss

9.The metastable state means a time interval of:
(A) 10^{-3} sec (B) 10^{-8} sec (C) 10^{3} sec (D) 10^{8} sec

10.Shear modulus is expressed as:
(A) $G=\frac{\tan\theta}{F/A}$ (B) $G=\frac{\tan\theta}{A}$ (C) $G=\frac{F/A}{\tan\theta}$ (D) $G=\frac{F}{\tan\theta}$

11.Dimensions of strain are:
(A) L^2 (B) L^{-2} (C) $ML^{-1}T^{-2}$ (D) No dimensions

12.Curie temperature for iron is: **(6 Times)**
(A) 0 K (B) 750 K (C) 1023 K (D) 378 K

13.A well-known example of an intrinsic semi-conductor is:
(A) Germanium (B) Phosphorous (C) Aluminum (D) Cobalt

14.How many crystal systems are there on the base of geometric arrangements of the atom
(A) 3 (B) 5 (C) 4 (D) 7

15.Holes can exist in:
(A) Super conductors (B) Conductors (C) Semi-conductors (D) Insulators

16.Out of the following which material is brittle: **(2 Times)**
(A) High carbon steel (B) Aluminum (C) Copper (D) Tungsten

17.Strain energy in deformed material is proportional to:
(A) Square of the extension (B) Under root of the extension
(C) Cube root of the extension (D) Extension produced

18.The amount of energy stored in the wire when it is deformed:
(A) $W=\frac{1}{2}F_1l_1^2$ (B) $W=\frac{1}{2}F_1^2l_1$ (C) $W=\frac{1}{2}F_1l_1$ (D) $W=2F_1l_1$

19.The stress that produces change in shape in known as:
(A) Tensile stress (B) Shear stress (C) Volume stress (D)Longitudinal stress

20.Chose the correct answer:
(A) An elastic deformation is reversible (B) An elastic deformation is irreversible
(C) A plastic deformation is reversible (D) An elastic deformation is permanent

21.Substances which undergo plastic deformation until they break are known as: **(2 times)**
(A) Brittle Substance (B) Ductile Substance

(C) Non-Magnetic Substance (D) Magnetic Substance

.Which of the following does not undergo plastic deformation?
(A) Copper (B) Iron (C) Lead (D) Glass

.Which one of the following is a polymeric solid?
(A) Glass (B) Nylon (C) Copper (D) Zinc

.To get N — type, the Ge is doped with:-
(a) Aluminum (b) Arsenic (c) Boron (d) Indium

.Substances which break just after the elastic limit is reached are called as:(4 times)
(a) Ductile Substances (b) Hard Substances (c) Brittle Substances (d) Soft Substances

.In extrinsic semiconductors doping is of the order of
(A) 1 atom to 10^4 (B) 1 atom to 10^8 (C) 1 atom to 10^3 (D) 1 atom to 10^6

Topic III: Electrical Properties of Solids:

.Minority carries in P-type substance are:
(A) Protons (B) Neutrons (C) Electrons (D) Positrons

.Good conductor have conductivities of the order of: (4 Times)
(A) $10^{-7}(\Omega m)^{-1}$ (B) $10^{7}(\Omega m)^{-1}$ (C) $10^{2}(\Omega m)^{-1}$ (D) $10^{-2}(\Omega m)^{-1}$

.To make n-type substance, antimony is mixed with:
(A) Boron (B) Indium (C) Germanium (D) Arsenic

.Conductivity of metals is of the order of:
(A) $10^{-4}\Omega^{-1}m^{-1}$ (B) $10^{-10}\Omega^{-1}m^{-1}$ (C) $10^{-20}\Omega^{-1}m^{-1}$ (D) $10^{7}\Omega^{-1}m^{-1}$

.Domains contain atoms:
(A) 10^{3} to 10^{6} (B) 10^{6} to 10^{9} (C) 10^{9} to 10^{12} (D) 10^{12} to 10^{16}

.At 0° K piece of 'Ge' or 'Si' is a perfect: (2 times)
(A) Conductor (B) Insulator (C) Semi-conductor (D)Paramagnetic

.If the conductivity of the material is high, then it is:
(A) An insulator (B) A semi-conductor (C) A good conductor (D) A super conductor

.The band in atom containing conductive electrons, according to band theory of solid is:
(A) Conduction band (B) Valance band
(C) Forbidden band (D) First conduction band then forbidden band

.The substance which have partially filled conduction bands are called:
(A) Insulator (B) Semi-conductor (C) Conductor (D) Super conductor

.The potential difference across the depletion region of Germanium is:
(A) 0.3 V (B) 0.5 V (C) 0.7 V (D) 0.8 V

.The potential barrier for silicon is: (3 Times)
(A) 0.3 V (B) 0.5 V (C) 0.7 V (D) 0.8 V

.Semi-conductor resistivity ranges________ $(\Omega m)^{-1}$:
(A) 10^{-6} to 10^{-4} (B) 10^{6} to 10^{4} (C) 10^{-6} to 10^{-8} (D) 10^{-8} to 10^{-16}

.When a silicon crystal is doped with a pentavalent element, it becomes:
(A) P-type semiconductor (B) n-type semiconductor
(C) Intrinsic semiconductor (D) Extrinsic semiconductor

.In n-type matrials, the minority carriers are:
(A) Free electrons (B) Holes (C) Protons (D) Mesons

.In N type material charge carries are:
(A) Free electorns (B) Holes (C) Protons (D) Mesons

Topic IV: Superconductors:

.The temperature below which resistivity of some materials becomes zero is called
(A) Kelvin temperature (B) Critical temperature
(C) Absolute zero temperature (D) Limiting temperature

.The critical temperature for mercury is: (4 Times)
(A) 7.2 K (B) 4.2 K (C) 1.18 K (D) 3.7 K

.The critical temperature (T_c) of lead is:
(A) 7.2 k (B) 3.72 k (C) 125 k (D) 77 k

.The critical temperature of aluminum is: (2 times)
(a) 3.72 K (b) 1.18K (c) 7.2 K (d)8.2 K

Topic V: Magnetic Properties of Solids:

.The substance in which the atom do not form the magnetic dipoles are called: (2 times)
(A) Diamagnetic (B) Paramagnetic (C) Ferromagnetic (D) Crystals

47.Hysteresis loss of the coil can be defined as:
(A) Energy loss (B) Step up process
(C) Step down process (D) Electromagnetic induction
48.The coercive current is:
(A) Magnetizing current (B) Current due to holes (C) Demagnetizing current (D) current due to ions
49.Very weak magnetic field produced by brain can be detected by:
(A) Compass (B) Metallic needle (C) Squids (D) Liquids
50.The substance in which atoms co-operate with each other in such a way so as to exhibit a strong magnetic field is called: **(2 times)**
(A) Ferromagnetic (B) Paramagnetic (C) Diamagnetic (D) Non magnetic
51.Domains are existed in:
(A) Ferromagnetic materials (B) Diamagnetic materials
(C) Paramagnetic materials (D) Semi conductors
52.The most suitable metal for making permanent magnet is: **(4 times)**
(A) Steel (B) Iron (C) Copper (D) Aluminum

2018

53. Very weak magnetic field produced by brain can be detected by:
(a) Compass (b) Metallic needle (c) squids (d) Liquids
54. In ferromagnetic substances, domain contains atoms nearly equal to: **(2 times)**
(a) 10^8 to 10^{12} (b) 10^{10} to 10^{14} (c) 10^{12} to 10^{16} (d) 10^{14} to 10^{18}
55. Very weak magnetic field produced by brain can be detected by: **(2 times)**
(a) Compass (b) Metallic needle (c) Squids (d) Liquids
56. If stress is increased beyond the elastic limit of material, it becomes permanently changed, this behaviour of material is called: **(2 times)**
(A) Elasticity (B) Plasticity (C) Yield Strength (D) Ultimate tensile strength
57. A vacant or partially filled band is called: **(2 times)**
(A) Fermi band (B) Valence band (C) Forbidden band (D) Conduction band
58. Glass and High carbon Steel are examples of: **(2 times)**
(A) Ductile Substances (B) Brittle Substances (C) Soft Substance (D) Hard Substances
59. Glass is also known as:
(A) Solid (B) Liquid (C) Solid liquid (D) Gas
60. A material which is insulator at 0K and conduct at room temperature is:
(A) Silver (B) Lead (C) germanium (D) Polythene
61. Conductors have conductivities of the order of:
(A) 10^{-6} $(\Omega m)^{-1}$ (B) 10^{7} $(\Omega m)^{-1}$ (C) 10^{9} $(\Omega m)^{-1}$ (D) 10^{3} $(\Omega m)^{-1}$
62. Curie temperature for iron is: **(2 times)**
(A) 780°C (B) 750°C (C) 730°C (D) 710°C
63. Which one pair belongs to acceptor impurity:
(a) Arsenic phosphorous (b) Boron, gallium (c) Antimony, Indium (d) Arsenic, Antimony

2019

64. Which one belongs to trivalent group?
(A) Aluminium (B) Antimoney (C) Phosphorous (D) Arsenic
65. Yttrium barium copper oxide ($YBa_2Cu_3O_7$) is superconductor at temperature:
(A) 163 K (B) 77 K (C) 4.2 K (D) 125 K
66. A device used to detect very weak magnetic field produced by brain is named as?
(A) MRI (B) CAT Scans (C) Squid (D) CRO
67. In extrinsic semi-conductors, doping is of the order of:
(A) 1 atom to 10^4 (B) 1 atom to 10^8 (C) 1 atom to 10^{16} (D) 1 atom to 10^6
68. Which one of the following is a polymeric solid:
(A) Glass (B) Nylon (C) Copper (D) Zinc
69. The source of Magnetism of an atom is the orbital and spin motion of:
(A) Proton (B) Neutron (C) Positron (D) Electron
70. The Young's Modulus of Mercury is:
(A) 70×10^9 Nm^{-2} (B) 15×10^9 Nm^{-2} (C) Zero (D) 91×10^9 Nm^{-2}
71. A single domain in paramagnetic substance contains nearly:
(A) $10^8 - 10^{10}$ atoms (B) $10^{15} - 10^{20}$ atoms (C) $10^{12} - 10^{20}$ atoms (D) $10^{12} - 10^{16}$ atoms
72. SI unit of modulus of elasticity is:
(A) Coulomb (B) Volt (C) Pascal / Nm (D) Ampere
73. In p-type substances, the majority charge carriers are:
(A) Electrons (B) Protons (C) Holes (D) Neutrons

2021

74. Which one of the following is the example of crystalline solid?
(A) Plastic (B) Glass (C) Rubber (D) Zirconia

75. Above the curie temperature iron is:
(A) paramagnetic (B) diamagnetic (C) ferromagnetic (D) remain same

76. Impurity atoms are doped in semi-conductor to increase:
(A) Free electrons (B) Holes (C) Conductivity (D) Resistivity

77. Young's modulus of lead is:
(A) $1.5\times10^9\ Nm^{-2}$ (B) $7.7\times10^9\ Nm^{-2}$ (C) $5.6\times10^9\ Nm^{-2}$ (D) $2.2\times10^9\ Nm^{-2}$

78. A Semi Conductor will behave as an Insulator at temperature:
(A) 0 K (B) $0^o C$ (C) 10 K (D) $10^o C$

79. Dimensions of strain are same as that of:
(A) Stress (B) Pressure
(C) Young's modulus (D) Relative permittivity

ANSWERS OF THE MULTIPLE CHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	D	C	B	C	A	C	C	A	C	D	C	A	D	C	A
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
D	C	B	A	B	D	B	B	C	D	C	B	C	D	D	B
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
C	A	B	A	C	A	B	B	A	B	B	A	B	A	A	C
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
C	A	A	A	C	C	C	B	D	B	C	C	B	B	B	A
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	
A	C	D	B	D	C	D	C	C	D	A	C	A	A	D	

SHORT QUESTIONS OF CHAPTER-17 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Classification of Solids:

1. Distinguish between crystalline and amorphous or glassy solids. (9 Times)

Ans: **Crystalline:** The solids in which there is a regular and periodic arrangement of the atoms and molecules are called crystalline solids.
For example ionic compound, ceramics etc.
Amorphous: The solids in which there is no regular arrangement of molecules like that in crystalline solids are called amorphous solids.
For example ordinary glass.

2. Define unit cell. (3 Times)

Ans: A crystalline solid consists of three dimensional pattern that repeat itself over and over again. This smallest three dimensional basic structure is called unit cell.

3. Define crystal lattice. (4 Times)

Ans: The whole structure obtained by the repetition of unit cell is known as crystal lattice.

4. Distinguish between Crystalline, Amorphous and Polymeric Solids. (8 Times)

Ans: **Crystalline:** The solids in which there is a regular and periodic arrangement of the atoms and molecules are called crystalline solids.
For example ionic compounds, ceramics etc.
Amorphous: Any non-crystalline solid in which the atoms and molecules are not organized in a definite lattice pattern. Such solids include glass, plastic, and gel.
Polymers: polymers are solid materials with a structure that is intermediate between order and disorder. They can be classified as partially or poorly crystalline solids. For example plastic, rubber etc.

5. Define polymeric solids and give example. (2 times)

Ans: **Polymeric solids**: polymers are solid materials with a structure that is intermediate between order and disorder. They can be classified as partially or poorly crystalline solids. For example plastic, rubber etc.

6. What are glassy solids? Do they possess property of flow?

Ans: Amorphous solids are called as glassy solids. Any non-crystalline solid in which the atoms and molecules are not organized in a definite lattice pattern is called glassy solid. Such solids include glass, plastic, and gel.
No, they do not possess the property of flow.

7. Differentiate between amorphous and polymeric solids.

Ans: **Amorphous** solid, any non-crystalline solid in which the atoms and molecules are not organized in a definite lattice pattern. Such solids include glass, plastic, and gel.
Polymers are said to be more or less solid materials with a structure that is intermediate between order and disorder. They can be classified as partially or poorly crystalline solids.

8. Define polymerization reaction. Write two examples of polymeric solids.

Ans: Polymers are formed by **polymerization** reactions. In these reactions relatively simple molecules are chemically combined into massive long chain molecules, or "three dimensional" structures.
Polythene and nylon are **examples** of polymeric solids.

9. Show that dimensions of Stress and Young's Modulus are the same.

Ans: As stress $\sigma = \frac{F}{A}$

$$Dim.\ of\ \sigma = \frac{Dim.\ of\ F}{Dim.\ of\ A}$$

$$= \frac{[MLT^{-2}]}{[L^2]} = [ML^{-1}T^{-2}]$$

As Young's Modulus $Y = \frac{stress\ \sigma}{strain\ \varepsilon}$

$$Dim.\ of\ Y = \frac{Dim.\ of\ \sigma}{Dim.\ of\ \varepsilon}$$

$$= \frac{[ML^{-1}T^{-2}]}{No\ Dimensions} = [ML^{-1}T^{-2}]$$

It is proved that dimension of stress and young's modulus are same.

Topic II: Mechanical Properties of Solids:

10. Distinguish between elasticity and plasticity. **(4 Times)**

Ans: **Elasticity:** In deformed crystalline solid, the atoms return to their equilibrium position after the removal of external force. This ability of the body to return to its original shape is called elasticity.
Plasticity: If the stress is increased beyond elastic limit, the specimen becomes permanently deformed. This is called plasticity.

11. How can the strain energy be determined from the force-extension graph?

Ans: Strain energy can be determined from the force-extension graph according to the following relation: $strain\ energy = \frac{1}{2} l_1 F_1$
where force F_1 is producing extension l_1 in the wire.

12. Define stress and strain. What are their SI units? **(14 Times)**

Ans: The force applied on unit area to produce any change in the shape, volume or length of a body is called stress.

$$\sigma = \frac{F}{A}$$

Its SI unit is Nm^{-2}. It is also called $pascal\ (Pa)$.
And, Strain is the measure of deformation of a solid when stress is applied to it. It has no units.

13. Differentiate between ductile and brittle substances. Give an example for each. **(14 Times)**

Ans: **Ductile substances:** Substances that undergo plastic deformation until they break are called ductile substances.
Lead, copper and wrought iron are ductile.

2nd year

Brittle substances: The substances which break just after the elastic limit is reached, are known as brittle substances.
Glass and high carbon steel are brittle.

14. **Define modulus of elasticity. Show that units of modulus of elasticity and stress are same.** **(12 times)**

Ans: The ratio of stress to strain is a constant for a given material, provided the external applied force is not too great, called modulus of elasticity.

$$modulus\ of\ elasticity = \frac{stress}{strain}$$

Since strain has no units, so modulus of elasticity will also be measured in Nm^{-2}. It is also called $pascal\ (Pa)$.

And

Stress is $\sigma = \frac{F}{A}$

Its SI unit is Nm^{-2}. It is also called $pascal\ (Pa)$.

It shows that modulus of elasticity and stress have same units.

15. **Differentiate between tensile and shear modes of stress and strain.** **(2 Times)**

Ans: **Tensile stress:** A stress that causes the change in length of an object is called tensile stress.

Shear stress: A stress that causes the change in shape of an object is called shear stress.

Tensile strain: If the strain is due to tensile stress, it is called tensile strain.

$$tensile\ strain = \frac{\Delta l}{l}$$

A strain produced in the object when it is subjected to shear stress is called shear strain.

$$shear\ strain = \frac{\Delta a}{a} = \tan\theta$$

16. **A 5m long wire is stretched by 2.5mm when a typical force is applied. Find the value of strain.**

Ans:

$$original\ length = l = 5\ m$$

$$change\ in\ length = \Delta l = 2.5\ mm = 0.0025\ m$$

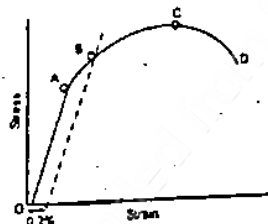
As

$$strain = \frac{\Delta l}{l}$$

$$strain = \frac{0.0025}{5}$$

$$strain = 0.0005$$

17. **Define the term Elastic limit and ultimate tensile stress from the graph of stress strain curve for a ductile material.**

Ans: The greatest stress that a material can endure without any permanent deformation is called elastic limit. This kind of behavior is called elasticity.
The region of plasticity is represented by the portion of the curve from B to C.
And
The maximum stress that a material can withstand is called ultimate tensile stress.
The point C represents ultimate tensile strength (UTS).

18. **Define volumetric strain.**

Ans: When the applied stress changes the volume, then the change in volume per unit volume is called volumetric strain.

$$volumetric\ strain = \frac{\Delta V}{V}$$

19. What is meant by strain energy? How can it be determined from the force extension graph? **(6 times)**

OR Define strain energy in deformed materials and write formula.

Ans: The amount of P.E stored in a material due to displacement of its molecules from its equilibrium position, under the action of stress, is called strain energy. Strain energy can be determined from the force-extension graph according to the following relation:

$$strain\ energy = \frac{1}{2} l_1 F_1$$

where force F_1 is producing extension l_1 in the wire.

20. Define (a) Elastic limit (b) Yield point(or strength). **(3 times)**

Ans: **Elastic limit:** The greatest stress that a material can endure without any permanent deformation is called elastic limit. This kind of behavior is called elasticity.

Yield point: The point on the stress-strain curve beyond which if stress is further increased then permanent deformation takes place in the given specimen. This is called yield point.

21. How n-type semi-conductors are formed?

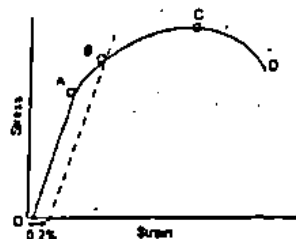
Ans: When a silicon crystal is doped with a pentavalent element, e.g., arsenic, antimony or phosphorous etc., four valence electrons of the impurity atom form covalent bond with the four neighbouring Si atoms, while the fifth valence electron provides a free electron in the crystal. Such a doped semi-conductor is called n-type semi-conductor.

22. Define yield point and ultimate tensile stress. **(2 times)**

Ans: **Yield point:** The point on the stress-strain curve beyond which if stress is further increased then permanent deformation takes place in the given specimen. This is called yield point.

Ultimate tensile stress: The maximum stress that a material can withstand is called ultimate tensile stress.

23. Define UTS of a material.

Ans: The maximum stress that a material can withstand is called ultimate tensile stress. The point C represents ultimate tensile strength (UTS).

24. Define ultimate tensile stress (UTS) and fracture stress.

Or Define ultimate tensile strength and fracture stress.

Ans: **Ultimate tensile strength (UTS):** The maximum stress that a material can withstand is called ultimate tensile strength and can be regarded as the nominal strength of the material.

Fracture stress: Once the limit of ultimate tensile stress (UTS) is crossed, the material breaks and the stress is called fracture stress.

Note: The correct word is Ultimate Tensile Strength. If there is ultimate tensile stress then you will write same answer and change strength to stress.

25. Define Modulus of Elasticity. Write down its three kinds. OR Define Young's modulus and Bulk modulus. **(5 times)**

Ans: **Modulus of Elasticity:** The ratio of stress to strain is a constant for a given material, provided the external applied force is not too great, called modulus of elasticity.

$$\text{modulus of elasticity} = \frac{\text{stress}}{\text{strain}}$$

Three different types are;

(i) The ratio of tensile stress to tensile strain is called Young Modulus(Y).

$$Y = \frac{F/A}{\Delta l/l}$$

(ii) The ratio of volumetric stress to volumetric strain is called Bulk Modulus (K).

$$K = \frac{F/A}{\Delta V/V}$$

(iii) The ratio of shear stress to shear strain is called Shear Modulus(G).

$$G = \frac{F/A}{\tan\theta}$$

26. **Define tensile stress and volumetric stress?**

Ans: <u>**Tensile Stress:**</u> When stress changes length of a body, it is called tensile stress.
<u>**Volumetric Stress:**</u> When stress changes volume of a body, it is called volumetric stress.

27. **Define plasticity and U.T.S.**

Ans: <u>**Plasticity:**</u> If the stress is increased beyond elastic limit, the specimen becomes permanently deformed. This is called plasticity.
<u>**Ultimate tensile stress (UTS):**</u> The maximum stress that a material can withstand is called ultimate tensile stress.

28. **Describe difference between proportional limit and elastic limit.**

Ans: <u>**Proportional limit:**</u> The greatest stress that a material can endure without losing straight line proportionality between stress and strain. Hooke's law is obeyed in this region.
<u>**Elastic limit:**</u> The greatest stress that a material can endure without any permanent deformation is called elastic limit. This kind of behavior is called elasticity.

$$\sigma = \frac{F}{A}$$

29. **Distinguish between elastic deformation and plastic deformation.**

Ans: If in deformed crystalline solid, the atoms return to their equilibrium position after the removal of external force then this is called **elastic deformation.**
If the dimensions of specimen change permanently and does not recover its original shape after the removal of strengthen this is called **plastic deformation.**

Topic III: Electrical Properties of Solids:

30. **How the conductivity of a semi-conductor can be raised?**

Ans: The conductivity of a semiconductor can be raised by the process of doping in which small number of impurity atoms are added to pure semiconductors.

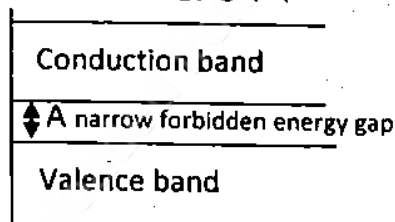
31. **Compare the electrical behavior of conductor and semi-conductor in terms of energy band theory.**

Ans: On the basis of energy band theory
In conductors, free electrons are available for conduction. Valence and conduction bands largely overlap each other.
And
In semiconductors, valence band and conduction band is partially filled and they have a very narrow forbidden energy gap.

32. **Describe energy band picture of semi-conductors.**

Ans: In semiconductors, valence band and conduction band is partially filled and they have a very narrow forbidden energy gap ($\approx 1eV$).

Conduction band

A narrow forbidden energy gap

Valence band

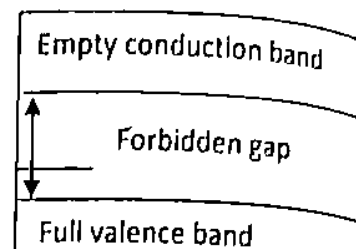
33. **Distinguish between a valence and conduction band.** **(3 times)**

Ans: <u>**Valance band:**</u> The energy band occupied by valance electrons is called the valance band.
The valance band may be either completely filled or partially filled with the

electrons but can never be empty.
Conduction band: The energy band occupied by free electrons is called the conduction band.
The conduction band may be empty or partially filled.

34. Describe energy band picture of insulators?

Ans: Insulators: Insulators are those materials in which valance electrons are bound very tightly to their atoms and are not free. In terms of energy bands, it means that an insulator has:
a) An empty conduction band (no free electron)
b) A full valence band
c) A large energy gap (several eV) between them.

Empty conduction band
Forbidden gap
Full valence band

35. Differentiate between Insulators and Conductors.

Ans: Insulators: Those substances which have valence electrons tightly bound to their atoms are called insulators. Almost they don't conduct electricity. e.g wood, glass, plastic, mica etc.
Conductors: Those substances which have plenty of free electrons for electrical conduction are called conductors. e.g. copper, gold, silver etc

36. What are the two main differences between conductors and semiconductors?

Ans: Conductors: Those substances which have plenty of free electrons for electrical conduction are called conductors. E.g. copper, gold, silver etc. Conductors have conductivity of the order of $10^7 (\Omega m)^{-1}$.
Semiconductors Those substances which have intermediate range of conductivities are called semiconductors e.g. germanium and silicon. Semiconductors can conduct electricity within conductivity order of 10^{-6} to 10^{-4} $(\Omega m)^{-1}$.

37. Carbon, Silicon and Germanium have four valence electrons. Why Carbon is insulator while Silicon and Germanium are Semiconductors?

Ans: Silicon and Germanium have the valence band much farther from the nucleus, where lesser energy. is needed to exchange electrons. Carbon on the other hand, is close to the nucleus which creates insulator-like properties.
Carbon is not a semiconductor because the forbidden energy gap in carbon is around 7eV. This is far much higher for it to be a semiconductor which has lower forbidden energy gaps.

38. What is the difference between intrinsic and extrinsic semiconductors? (10 times)

Ans: Intrinsic Semiconductor:
A semiconductor in its extremely pure form is known as intrinsic semiconductors. Pure elements of silicon and germanium are intrinsic semiconductors. These semi-conductor elements have atoms with four valence electrons.
Extrinsic Semi-conductors:
The doped semi-conducting materials are called extrinsic semi-conductors. The electrical behavior of semiconductors is substantially changed on introducing a small impurity into pure semi-conductor, and this process is called doping.
P-type and N-type are extrinsic semi-conductors.

39. Discuss the mechanism of electrical conduction by holes and electrons in a pure semi-conductor. (4 times)

Ans: At 0 K semiconductors are perfect insulators. However, at room temperature there are some free electrons in the conduction band and holes in the valance band. When a battery is connected to such a semi-conductor, the electrons drift towards the positive end whereas the holes drift towards the negative end of the semi-conductor. Hence, the current flowing through the semi-conductor is carried by both electrons and holes. It may be noted that the electronic current and charged hole current add up together to give the current I.

40. Distinguish between p-type semiconductor and n-type semiconductor. (2 times)

Ans: p-type semiconductor: When a trivalent impurity such as aluminium is added into the semi-conductor, holes are generated and p-type semi-conductor is formed. Holes are positive charge carriers.

n-type semiconductor: When a pentavalent impurity such as phosphorus is added into the semi-conductor, free electrons are generated and n-type semi-conductor is formed. Charge carriers in n-type are free electrons.

41. What are conductors and super conductors.

Ans: Those substances which have plenty of free electrons for electrical conduction are called **conductors**. Conductors have conductivity of the order of $10^7 (\Omega m)^{-1}$.
The materials whose resistivity becomes zero below a certain temperature are called **super conductors**. For example, mercury becomes super conductor below 4.2K temperature.

42. How would you obtain N – type and P – type material from pure silicon? Illustrate it by schematic diagram.

Ans: When a silicon crystal is doped with a pentavalent element, four valence electrons of the impurity atom form covalent bond with the four neighbouring silicon atoms, while the fifth valence electron provides a free electron in the crystal. In this way, N – type material is formed.
When a silicon crystal is doped with a trivalent element, three valence electrons of the impurity atom form covalent bond with the three neighbouring silicon atoms, while the one missing electron in the covalent bond with the fourth neighbouring silicon atom provides a hole. In this way, P – type material is formed.

Topic IV: Superconductors:

43. What is critical temperature in super conductivity?

Ans: The temperature below which the resistivity of a material falls to zero is called critical temperature. For example, mercury has T_c= 4.2 k.

44. What are super conductors? Write their uses. OR write the name of four applications of super conductivity. (23 times)

OR Define super-conductor. Write down its two technological applications.

Ans: The materials whose resistivity becomes zero below a certain temperature called critical temperature are called superconductors.
For example, mercury becomes super conductor below 4.2 k temperature.
Superconductors can be used in

a) Magnetic Resonance Imaging (MRI) b) Magnetic Levitation Trains
c) Powerful but small electric motors d) Fast computer chips

45. Define (a) Super conductor (b) Critical temperature

Ans: <u>Super conductor:</u> The materials whose resistivity becomes zero below a certain temperature are called superconductors. For example, mercury becomes super conductor below 4.2 k temperature.
<u>Critical temperature:</u> The temperature below which the resistivity of a material falls to zero is called critical temperature. For example, mercury has T_c= 4.2 k.

46. What are superconductors? Write their types.

Ans: There are some materials whose resistivity becomes zero below a certain temperature, called critical temperatures. Below this temperature, such materials are called **super conductors**.
There are two types of super conductors
Super Conductors with a critical temperature above than 77K are high temperature super conductors and below 77K are called low temperature super conductors.

Topic V: Magnetic Properties of Solids:

47. What does area of hysteresis loop tell?

Ans: The area of the loop is the measure of the energy needed to magnetize and demagnetize the specimen during each cycle of the magnetizing current. This is the energy required to do work against internal friction of the domains. This work is dissipated as heat. It is called hysteresis loss.

48. Explain what is Curie temperature?

OR What is curie temperature? Writ the curie temperature of iron.

Ans: The temperature at which the dofmains of a ferromagnetic material start losing their orderliness is called Curie temperature.
For example the Curie temperature of iron is $750^o\ C$.

49. Define Dia and paramagnetic substance. Give one example of Dia and paramagnetic substance. (4 Time)

Ans: In diamagnetic substance, there is no resultant field as the magnetic field produced by both orbital and spin motions of the electron might add up to zero.

For example, the atoms of water, copper, bismuth etc.
And
The solids in which the orbital and spin axes of the electrons in an atom are so oriented that their fields support each other are called paramagnetic substances. In these solids, each atom behaves like a tiny magnet.
For example, ozone, platinum etc.

50. What is hysteresis loss? **(2 times)**

Ans: The area of the hysteresis loop is a measure of the energy needed to magnetize and demagnetize the material in each cycle. This is the energy required to do work against the internal friction of the domains. This work is dissipated as heat and is called hysteresis loss.

51. Define coercivity of a material. **(2 times)**

Ans: To demagnetize the material, the magnetizing current is reversed and increased to reduce the magnetization to zero. This is known as coercive current. And this process is called coercivity.

52. What is meant by Ferromagnetic substances? **(2 Times)**

Ans: In ferromagnetic substances, the atoms cooperate with each other in such a way so as to exhibit a strong magnetic effect. In ferromagnetic substance, there exist small regions called domains. For example Fe, Co and Ni are ferromagnetic substances.

53. What are Paramagnetic Substances? Give an example. **(2 times)**

Ans: The solids in which the orbital and spin axes of the electrons in an atom are so oriented that their magnetic fields support each other are called paramagnetic substances. In these solids, each atom behaves like a tiny magnet.
For example, ozone, platinum etc.

54. Differentiate between paramagnetic and ferromagnetic substances with examples. **(5 Times)**

OR What is meant by paramagnetic and Feromagnetic substances?

Ans: __Paramagnetic:__ The solids in which the orbital and spin axes of the electrons in an atom are so oriented that their magnetic fields support each other are called paramagnetic substances. In these solids, each atom behaves like a tiny magnet.
For example, ozone, platinum etc.

__Ferromagnetic:__ In ferromagnetic substances, the atoms cooperate with each other in such a way so as to exhibit a strong magnetic effect. In ferromagnetic substance, there exist small regions called domains. For example Fe, Co and Ni are ferromagnetic substances.

55. Define retantivity and coercivity. **(3 Times)**

Ans: __Retantivity:__ When the current is reduced to zero, the material still remains strongly magnetized which is known as remanence or retantivity

__Coercivity:__ The value of reverse current which is required by a substance for its demagnetization is called coercive current or coercivity.

56. Distinguish between critical and curie temperatures. **(2 times)**

Ans: __Critical temperature:__ The temperature below which the resistivity of a material falls to zero is called critical temperature. For example, mercury has $T_c = 4.2$ k.

__Curie temperature:__ The temperature at which the domains of a ferromagnetic material start losing their orderliness is called Curie temperature.
For example the Curie temperature of iron is $750°C$.

57. Distinguish between soft magnetic materials and hard magnetic materials. **(2 Times)**

Ans: __Soft magnetic:__ The materials in which their domains can be easily oriented on applying external magnetic field and also return to original positions when field is removed. E.g. iron.

__Hard magnetic:__ The materials in which their domains cannot be easily oriented on applying external magnetic field. But once the domains are lined up by a very strong magnetic field, they will restrain their positions after the removal of magnetic field. e.g., steel, alnico V etc.

58. Energy dissipated per cycle for steel is more as compared to iron. Why? **(2 times)**

Ans: Steel is a material in which domains cannot be easily oriented on applying external magnetic field. But once the domains are lined up by a very strong magnetic field, they will restrain their positions after the removal of magnetic field. It is a hard magnetic material.
The area of loop is a measure of energy required to magnetize and demagnetize

each cycle. As area of loop for steel is large as compared to the iron, so energy loss per cycle for steel is more than for iron.

59. **What is meant by Hysteresis loss? How is it used in the construction of transformer?** **(10 times)**

Ans: The area of the loop is the measure of the energy needed to magnetize and demagnetize the specimen during each cycle of the magnetizing current. This is the energy required to do work against internal friction of the domains. This work is dissipated as heat. It is called hysteresis loss.

Soft iron frame is used as the core of a transformer because it has a small hysteresis area which represents that small energy is lost during its magnetization and demagnetization. In this way, hysteresis loss is useful to decide either the material is suitable for construction of transformer or not.

60. **Define Saturation and Remanence of Hysteresis Loop.**

Ans: **Saturation:** The material is said to be magnetically saturated when magnetic flux density reaches a maximum value.

Remanence: When the current is reduced to zero, the material still remains strongly magnetized. It is due to the tendency of domains to stay partly in line, once they have been aligned. It is called remanence or relativity.

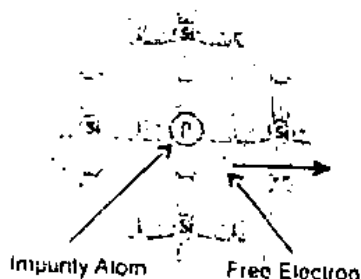
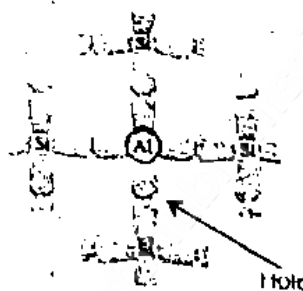
61. **What is meant by Dia and Ferromagnetic substances? Give example for each.** **(2 times)**

Ans: Substances in which the orbits and the spin axes of the electrons in an atom are so oriented that their magnetic fields add up to zero are called **Diamagnetic substances.** For example, Water, Copper, Bismuth etc.

Substances in which the atoms co-operate with each other in such a way so as to exhibit a strong magnetic effect are called **Ferromagnetic substances.** There exists small regions called domain. For example Fe, Co, Ni etc.

62. **What do you mean by hysteresis and hysteresis loss?**

Ans: From hysteresis loop, it may be noted that the value of flux density for any value of current is always greater when the current is decreasing than when it is increasing, i.e, magnetism lags behind the magnetizing current. This phenomenon is known as **hysteresis.**

The energy required to magnetize and demagnetize the specimen during each cycle of magnetizing current is dissipated as heat. This energy loss is called **hysteresis loss.**

N – type material

P – type material

63. **Explain the term Hysteresis.**

Ans: From Hysteresis loop, it may be noted that the value of flux density for any value of current is always greater when the current is decreasing than when it is increasing, i.e, magnetism lags behind the magnetizing current. This phenomenon is known as **Hysteresis.**

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64. **What is meant by para, dia and ferromagnetic substances? Give example for each.** **(2 Times)**

Ans: The orbits and the spin axes of the electrons in an atom are so oriented that their fields spot each other and the atom behaves like a tiny magnet. Substances with such atoms are called **paramagnetic substances.** e.g., ozone, platinium.

Substances in which the orbits and the spin axes of the electrons in an atom are so oriented that their magnetic fields add up to zero are called **Diamagnetic substances.** e.g., Water, Copper, Bismuth etc.

There are some solid substances in which the atoms cooperate with each other in such a way so as to exhibit a strong magnetic field. They are called **ferromagnetic substances.** e.g., Fe, Co, Ni etc.

65. Differentiate between tensile and compressive mode of stress and strain.

Ans: **Tensile stress** is the normal force per area (σ = F/A) that causes an object to increase in length. **Compressive stress** is the normal force per area (σ = F/A) that causes an object to decrease in length.

Tensile strain is the fractional increase in length of an object ($\varepsilon = \Delta\ell/\ell_0$) due to a tensile stress. **Compressive strain** is the fractional decrease in length of an object ($\varepsilon = \Delta\ell/\ell_0$) due to a compressive stress

66. Draw a stress-strain curve for a metallic wire and mention the points representing proportional limit, elastic limit, UTS or nominal strength and fracture stress. OR
Draw a stress-strain curve for a ductile material and define the term yield point and ultimate tensile strength.

Ans:

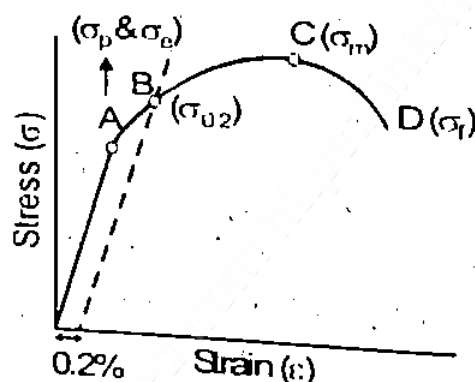
i. Proportional limit is the greatest stress that a material can endure without losing straight line proportionality between stress and strain (O to A)

ii. The greatest stress that a material can endure without any permanent deformation is called elastic limit. This kind of behavior is called elasticity (O to B).

iii. The point on the stress-strain curve beyond which if stress is further increased then permanent deformation takes place in the given specimen. This is called yield point (Point B).

iv. The region of plasticity is represented by the portion of the curve from *B* to *C*.

v. The maximum stress that a material can withstand is called ultimate tensile stress. The point *C* represents ultimate tensile strength (UTS).

vi. Once the limit of ultimate tensile stress (UTS) is crossed, the material breaks and the stress is called fracture stress (Point D).

67. Why does the doping not change the basic structure of the solid? Explain.

Ans: Because doping or adding impurities is a technique used to vary the number of electrons and holes in semiconductors lattice and can change the electrical conductivity not the basic structure of the lattice. Therefore, vary the efficiency of the semiconductor.

68. Explain the elastic constant.

Ans: The ratio of stress to strain is a constant for a given material, provided the external applied force is not too great, called elastic constant or modulus of elasticity.

$$modulus\ of\ elasticity = \frac{stress}{strain}$$

Since strain has no units, so modulus of elasticity will also be measured in Nm^{-2}. It is also called $pascal\ (Pa)$.

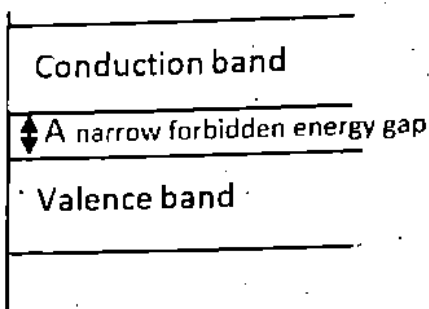
69. **Define retentivity and coercive current.**

Ans: **Retentivity:** When the current is reduced to zero, the material still remains strongly magnetized which is known as remanence or retentivity

Coercive current: The value of reverse current which is required by a substance for its demagnetization is called coercive current or coercivity.

70. **Explain briefly semiconductors in term of energy bands theory.**

Ans: In terms of energy bands, semiconductors are those materials which at room temperature have

i) A partially filled conduction band
ii) A partially filled valence band
iii) A very narrow forbidden energy gap (of the order of 1 eV) between the conduction and valence bands.

Conduction band
A narrow forbidden energy gap
Valence band

LONG QUESTIONS OF CHAPTER-17 IN ALL PUNJAB BOARDS 2011-2021

Topic II: Mechanical Properties of Solids:

1. What is meant by strain energy? Derive the relation for strain energy in a deformed material from the area under force extension graph. **(8 Times)**
2. Define Strain Energy. Derive a relation for Strain Energy in deformed materials. **(3 Times)**
3. Define extrinsic and intrinsic semi-conductors. How P-type and N-type semi-conductors are formed? Explain.
4. Define stress and strain. Write a note on Young's, Bulk and shear moules.

Topic III: Electrical Properties of Solids:

5. What is the energy band theory? How behaviors of electrical conductors, insulators and semi-conductors can be explained on the basis of energy band theory. **(15 Times)**
6. What is doping? Describe the formation of n-type and p-type semi-conductor. **(2 Times)**
7. What are semi-conductors? Discuss the formation of P-type and N-type material with their Schematic diagram.
8. Define extrinsic and intrinsic semiconductors. How can we obtain P-type and N-type substance? **(5 Times)**

NUMERICAL PROBLEMS OF CHAPTER-17 IN ALL PUNJAB BOARDS 2011-2021

Topic II: Mechanical Properties of Solids:

1. **A 1 m long copper wire is subjected to stretching force and its length increase by 2 cm. Calculate the tensile strain in the wire.**

Ans: Given that

$$length\ of\ wire = l = 1\ m$$
$$elongation = \Delta l = 2\ cm = 0.02\ m$$
$$tensile\ strain = \varepsilon = ?$$

Since

$$\varepsilon = \frac{\Delta l}{l}$$
$$\varepsilon = \frac{0.02}{1} \boxed{= 0.02}$$

2. **A 1.25 cm diameter cylinder is subjected to a load of 2500 kg. Calculate the stress on the bar in mega Pascal.** **(20 Times)**

Ans: Given that

$$diameter = d = 1.25\ cm$$
$$radius = r = \frac{d}{2} = \frac{1.25}{2} = 0.62\ cm$$
$$radius = r = 0.0062\ m$$
$$load = m = 2500\ kg$$
$$stress = \sigma = ?$$

As

$$\sigma = \frac{F}{A}$$
$$\sigma = \frac{mg}{\pi r^2}$$
$$\sigma = \frac{(2500)(9.8)}{(3.14)(0.0062)^2} = 200 \times 10^6\ Pa \boxed{= 200\ MPa}$$

3. **A 1 m long copper wire is subjected to stretching force and its length increase by 20 cm. Calculate the tensile strain and the percent elongation which the wire undergoes.** **(5 times)**

Ans: Given that

$$length\ of\ wire = l = 1\ m$$
$$elongation = \Delta l = 20\ cm = 0.2\ m$$
$$tensile\ strain = \varepsilon = ?$$
$$percent\ elongation = ?$$

Since

$$\varepsilon = \frac{\Delta l}{l} = \frac{0.2}{1} \boxed{= 0.2}$$

And

$$percent\ elongation = \frac{\Delta l}{l} \times 100\%$$
$$percent\ elongation = \frac{0.2}{1} \times 100\%$$
$$percent\ elongation = 0.2 \times 100\% \boxed{= 20\%}$$

4. **A wire 2.5 m long and cross-section area $10^{-5} m^2$ is stretched by 1.5 mm by a force of 100 N. Calculate Young's modulus.** **(2 Time)**

Ans: Given that

$$l = 2.5\ m$$
$$\Delta l = 1.5\ mm = 1.5 \times 10^{-3}\ m$$
$$A = 10^{-5} m^2$$
$$F = 100\ N$$
$$Y = ?$$

Since

$$Young's\ modulus = \frac{stress}{strain}$$
$$Y = \frac{F/A}{\Delta l/l}$$

$$Y = \frac{Fl}{A\Delta l}$$

$$Y = \frac{(100)(2.5)}{(10^{-5})(1.5 \times 10^{-3})} \boxed{= 1.66 \times 10^{10}\ Pa}$$

5. The length of a steel wire is $1.0\ m$ and its cross sectional area is $0.03 \times 10^{-4} m^2$. Calculate the work done in stretching the wire when a force of $100\ N$ is applied within the elastic region. Young's modulus of steel is $3.0 \times 10^{11} Nm^{-2}$. (4 times)

Ans: Given that

$$l = 1.0\ m$$
$$A = 0.03 \times 10^{-4} m^2$$
$$F = 100\ N$$
$$Y = 3.0 \times 10^{11} Nm^{-2}$$
$$work\ done = W = ?$$

As

$$Young's\ modulus = \frac{stress}{strain}$$

$$Y = \frac{F/A}{\Delta l/l}$$

$$Y = \frac{Fl}{A\Delta l}$$

$$\Delta l = \frac{Fl}{AY}$$

$$\Delta l = \frac{(100)(1)}{(0.03 \times 10^{-4})(3.0 \times 10^{11})}$$ (2 Times)

$$\Delta l = 1.1 \times 10^{-4}\ m$$

Now

$$work\ done = average\ force \times distance$$

$$W = \left(\frac{0 + F}{2}\right)(\Delta l)$$

$$W = \frac{1}{2} F\Delta l$$

$$W = \frac{1}{2}(100)(1.1 \times 10^{-4}) \boxed{= 5.6 \times 10^{-3} J}$$

6. What stress would cause a wire to increase in length $0.01\ \%$ if the young modulus of the wire is $12 \times 10^{10}\ Pa$? What force would produce this stress if the diameter of the wire is $0.56\ mm$? (9 Times)

Ans: Given that

$$l = 1\ m$$
$$\Delta l = 0.01\% = \frac{0.01}{100} = 10^{-4}\ m$$
$$Y = 12 \times 10^{10}\ Pa$$
$$d = 0.56\ mm = 0.56 \times 10^{-3}\ m$$
$$r = \frac{d}{2} = \frac{0.56 \times 10^{-3}}{2} = 0.28 \times 10^{-3}\ m$$
$$stress = \sigma = ?$$
$$force = F = ?$$

Since

$$Young's\ modulus = \frac{stress}{strain}$$

$$Y = \frac{\sigma}{\Delta l/l}$$

$$\sigma = Y\left(\frac{\Delta l}{l}\right)$$

$$\sigma = \frac{12 \times 10^{10} \times 10^{-4}}{1}$$

$$\sigma = 12 \times 10^{6} Pa \boxed{= 1.2 \times 10^{7}\ Pa}$$

And $stress = \frac{force}{area}$

$$\sigma = \frac{F}{A}$$
$$F = \sigma A$$
$$F = \sigma \pi r^2$$
$$F = (1.2 \times 10^7)(3.14)(0.28 \times 10^{-3}) \boxed{= 2.96\ N}$$

7. **A steel wire 12 mm in diameter is fastened to a log and is then pulled by tractor. The length of steel wire between the log and tractor is 11m. A force of 10,000 N is required to pull the log. Calculate**

a) the stress in the wire and

b) The strain in the wire. $(E = 200 \times 10^9\ Nm^{-2})$

c) How much does the wire stretch when the log is pulled?

Ans:

$$d = 12mm$$
$$r = \frac{d}{2} = \frac{12mm}{2} = 6mm = 6 \times 10^{-3} m$$
$$E = 200 \times 10^9\ Nm^{-2}$$
$$l = 11m$$
$$F = 10,000N$$

a) Stress $\sigma = ?$

b) Strain $\varepsilon = ?$

c) $\Delta l = ?$

a) **stress in given by**

$$\sigma = \frac{F}{A}$$
$$\sigma = \frac{F}{\pi r^2}$$

Putting values ,

$$\sigma = \frac{10,000}{(3.14)(6 \times 10^{-3})^2}$$
$$\sigma = 88.46 \times 10^6\ Pa$$
$$\sigma = 88.46\ MPa$$

b) As $E = \frac{stress}{strain}$

$$E = \frac{\sigma}{\varepsilon}$$

or $\varepsilon = \frac{\sigma}{E}$

$$\varepsilon = \frac{88.46 \times 10^6}{200 \times 10^9}$$
$$\varepsilon = \frac{0.442}{10^3}$$
$$\varepsilon = 4.42 \times 10^{-4}$$

c) As $\varepsilon = \frac{\Delta l}{l}$

or $\Delta l = \varepsilon l$

$$\Delta l = 4.42 \times 10^{-4} \times 11$$
$$\Delta l = 4.86 \times 10^{-3} m$$
$$\Delta l = 4.86\ mm$$

OBJECTIVES (MCQ'S) OF CHAPTER-18 IN ALL PUNJAB BOARDS 2011-2021

Topic I: P-N Junction:

1. The potential barrier for Ge at room temperature is: **(4 Times)**
(A) 0.3 volt (B) 3 volt (C) 1 volt (D) 5 volt

2. The junction potential for Germanium Is:
(A) 3 V (B) 0.3 V (C) 7 V (D) 0.7 V

3. In n-p-n transistor current does not flow in the direction from:
(A) Emitter to collector (B) Emitter to base
(C) Base to collector (D) Collector to emitter

4. A semi-conductor will behave as insulator when:
(A) High P.D is applied across it (B) When its temperature is 0 K
(C) Pentavalent impurity is added (D) Trivalent impurity is added

5. The characteristics curve of p-n junction is between:
(A) Voltage and current (B) Voltage and time
(C) Current and time (D) Power and current

6. The PN junction on forward biasing acts as:
(A) Capacitor (B) High resistor (C) Inductor (D) Low resistor

7. The reverse current in a p-n junction flows due to: **(2 Times)**
(A) Majority charge carriers (B) Minority charge carriers
(C) Both A and B (D) None of these

8. A pentavelent impurity is:
(A) Boron (B) Aluminum (C) Indium (D) Phosphorous

9. When a p-n junction is reverse biased the depletion region is:
(A) Widened (B) Narrowed (C) Normal (D) None of these

10. Depletion region carries:
(A) – ve charge (B) +ve charge (C) Ions (D) No charge

11. The potential barrier for silicon at room temperature is: **(3 Times)**
(A) 0.3 Volt (B) 0.4 Volt (C) 0.5 Volt (D) 0.7 Volt

12. SI unit of current gain is: **(2 Times)**
(A) Ampere (B) volt (C) coulomb (D) no unit

13. Which type of impurity is to be added to a pure semi-conductor crystal to provide holes:
(A) Monovalent (B) Trivalent (C) Tetravalent (D) Pentavalent

14. In p-type substances, the minority carries are: **(2 Times)**
(a) Electrons (b) protons (c) holes (d) neutrons

15. Which one pair belongs to accepter impurity?
(a) Arsenic, Phosphorus (b) Boron, Gallium
(c) Antimony, Indium (d) Arsenic, Antimony

16. Potential difference across two terminals of silicon diode at 300 k is:
(a) 0.3 V (b) 0.7 V (c) 0.9 V (d) 1.2 V

17. Which one is pentavalent impurity?
(a) Boron (b) Gallium (c) Antimony (d) Indium

18. Potential Difference Across Depletion Region in case of Silicon Diode at room temperature is :
(A) 0.3 V (B) 0.9 V (C) 0.7 V (D) Zero Volts

19. The size of base of transistor is **(2 Times)**
(A) 10^{-3}m (B) 10^{-4} m (C) 10^{-6}m (D) 10^{2}m

20. Which diode works at reverse biasing?
(A) LED (B) photovoltaic cell (C) photodiode (D) silicon diode

21. The number of terminals in a semiconductor diode are:
(A) 2 (B) 3 (C) 4 (D) 5

Topic II: Rectification:

22. Process of converting alternative current into direct current is called:
(A) Polarization (B) Modulation (C) Rectification (D) Amplification

23. The device used for rectification is called: (2 Times)
(A) Rectifier (B) Transformer (C) Thermistor (D) Wheat stone bridge
24. Pulsating DC can be made smooth by using a circuit known as: (2 times)
(A) Filter (B) Tank (C) Accepter (D) All
25. AC can be converted into DC by: (2 Times)
(A) Transformer (B) Rectifier (C) Motor (D) Capacitor
26. In full wave rectification no of diodes required are equal to: (2 Times)
(A) 3 (B) 4 (C) 5 (D) 1
27. The device used for converting A.C into D.C is called:
(A) Oscillator (B) Detector (C) Amplifier (D) Rectifier (or diode)

Topic III: Specially Designed P-n Function:

28. [symbol] is the electrical symbol of:
(A) Diode (B) Photodiode (C) Photo cell (D) LED
29. A diode characteristics curve is a graph plotted between: (2 Times)
(A) Current and time (B) Voltage and time
(C) Voltage and current (D) Forward voltage and reverse current
30. The automatic working of street lights is due to:
(A) Inductor (B) Capacitor (C) Comparator (D) Rectifier
31. A sensor of light is: (3 Times)
(A) Transistor (B) LED (C) Diode (D) Light dependent resistor
32. The colour of light emitted by a LED depends on: (2 Times)
(A) Its forward biasing (B) the type of semi conductor material use
(C) The amount of forward current (D) its reverse biasing
33. Automatic functioning of street light can be done by the use of:-
(a) Inductor (b) Capacitor (c) Comparator (d) Thermistor
34.The use of LDR is in the circuit of:
(a) night switch (b) logic gate (c) rectifier (d) oscillator

Topic IV: Transistor as an Amplifier:

35. If I_E.I_B and I_C are emitter current, base current and collector current respectively in a transistor then:
(A) $I_C = I_B . I_E$ (B) $I_B = I_E . I_C$ (C) $I_E = I_B + I_C$ (D) $I_C = I_E + I_B$
36. Transistors are made from: (2 Times)
(A) Plastics (B) Metals (C) Conductors (D) Dopped semiconductors
37. The thickness of the base of the transistor is of the order of:- (2 Times)
(a) 10^6 m (b) 10^{-6} m (c) 10^{-3} m (d) $10^{-6}\mu$ m
38. The width of central region of base of a transistor is: (2 Times)
(a) $10^{-4} m$ (b) $10^{-6} m$ (c) $10^{-3} m$ (d) $10^{-9} m$
39. The term transistor stands for:
(A) Transfer of current (B) Transfer of voltage (C) Transfer of resistance (D) Transfer of charge
40. The central region of a transistor is called. (3 Times)
(A) Base (B) emitter (C) Collector (D) Neutral
41. Photo diode is used for detection of:
(A) Heat (B) Magnet (C) Current (D) Light
42. Voltage gain of the common emitter npn-transister as an amplifier is:
(A) $\beta \frac{rie}{Rc}$ (B) $\beta \frac{Ic}{Rc}$ (C) $\beta \frac{Ve}{Rc}$ (D) $\beta \frac{Rc}{rie}$
43. A transistor consists of:
(A) Three electrodes (B) Two electrodes (C) One electrode (D) Five electrodes

Topic V: Transistor:

44. Voltage gain of the transistor as an amplifier is negative because of:
(A) Input voltage is amplified (B) Phase shift of 180°
(C) Output voltage is amplified (D) Phase shift is 0°
45. The gain of transistor amplifier depends upon.
(A) Resistance connected with collector (B) Resistance connected at base
(C) Input voltage (D) Output voltage

46. The gain of amplifier is given as:

(a) $-\beta R_C / r_{ie}$ (b) $-\beta r_{ie} / R_C$ (c) $\frac{-R_2}{R_1}$ (d) $1+\frac{R_2}{R_1}$

Topic VI: Trasistor as a Switch:

47. Find the gain of inverting amplifier of external resistance $R_1 = 10K\Omega$ and $R_2 = 100K\Omega$: **(3 Times)**

(A) -5 (B) -10 (C) -2 (D) 50

Topic VII: Operational Amplifier:

48. Integrated amplifier is known as:

(A) Power amplifier (B) Pull-push amplifier (C) perational amplifier (D) current amplifier

49. Gain of operational amplifier is independent of:

(A) Internal structure (B) External structure (C) Batteries (D) Potential changes

50. The open loop gain of an operational amplifier is of the order of: (7 Times)

(A) 10^8 (B) 10^5 (C) 10^2 (D) 10^{-3}

51. The device which is used as amplifier and works with negative feedback is:

(A) Operational amplifier (B) n-p-n transistor (C) p-n-p transistor (D) Transistor

52. The input resistance of an op-amplifier is: **(3 Times)**

(A) Zero (B) Low (C) High (D) Equal to output resistance

Topic IX: Op. Amp as Non-Inverting Amplifier:

53. For non-inverting amplifier if $R_1 = \infty$ and $R_2 = 0$ ohm, the gain of non-inverting amplifier is: **(3 Times)**

(A) -1 (B) Zero (C) +1 (D) Infinite

54. The current gain β on a transistor is: **(4 times)**

(A) I_C/I_E (B) I_E/I_B (C) I_C/I_B (D) I_B/I_C

Topic X: Comparator at a Night Switch:

55. Automatic functioning of street light can be done by the use of: (4 times)

(A) Inductor (B) Capacitor (C) Emf (D) comparator

Topic XI: Fundamental Logic Gates:

56. Logic gates can control some physical parameters like:

(A) Temperature pressure (B) Current, voltage
(C) Resistance, inductance (D) Capacitance, impedance

57. The term invertor is used for:

(A) NOR gate (B) NAND gate (C) XNOR gate (D) NOT gate

58. The electric current which gives the inversion:

(A) X-NOR gate (B) OR gate (C) AND gate (D) NOT gate

59. The output of "AND" gate will be one, when:

(A) Both inputs are at zero (B) Either one input is at one
(C) Both inputs are at one (D) None of them

60. A NAND gate with two inputs A and B has an output 0 if:

(A) A is 0 (B) B is 0 (C) A and B are 0 (D) A and B are 1

61. The mathematical notation for NAND gate is: **(3 Times)**

(A) $X = \overline{A+B}$ (B) $X = \overline{A.B}$ (C) $X = A+B$ (D) $X = A.B$

62. Which one of the following is not a basic logic gate:

(A) NOT gate (B) NOR gate (C) AND gate (D) OR gate

63. The mathematical symbol for NOR operation is:

(A) $X = A.B$ (B) $X = \overline{A.B}$ (C) $X = A + B$ (D) $X = \overline{A+B}$

64. Which is not a basic logic operation:

(A) NOT (B) AND (C) OR (D) NAND

65. Truth Table of Logic Function:

(A) Summarizes its output values only (B) Tabulates all its input conditions only
(C) Display all its input and output possibilities (D) Is not base on logic algebra

66. A two inputs NAND gate with inputs A and B has an output 0, if: **(2 Times)**

(A) B is zero (B) A is zero (C) Both A and B are 1 (D) both A and B are 0

67. The common door bell requires a voltage of about:
(A) 9 Volts (B) 8 Volts (C) 7 Volts (D) 6 Volts

68. $X = \overline{A + B}$ is the mathematical notation for:
(A) OR-gate (B) NOR-gate (C) NAND gate (D) AND gate

Topic XII: Digital Systems:

69. The no. of LED's needed to display all the digits is:
(A) 4 (B) 5 (C) 6 (D) 7

70. Output resistance of an op-amp is: **(2 Times)**
(A) High (B) Zero (C) Low (D) Equal to input resistant

71. A device which converts low voltage or current to high voltage or current is called:
(A) Transformer (B) AC-generator (C) Rectifier (D) Amplifier

72. In photovoltaic cell, current is directly proportional to:
(a) Wavelength of light (b) Intensity of light (c) Frequency of light (d) Energy

73. The Boolean expression of NAND gate is: **(3 Times)**
(A) $X = A.B$ (B) $X = A - B$ (C) $X = A + B$ (D) $X = \overline{A.B}$

74. The Boolean equation for exclusive OR – gate is given by: **(2 Times)**
(A) $X = A.B + B.A$ (B) $X = A.\bar{B} + \bar{A}.B$ (C) $\bar{A}.\bar{B} + A.B$ (D) $X = \overline{A.B + A.B}$

2018

75. Thickness of a base in a transistor is of the order of: **(3 Times)**
(a) 10^{-3} m (b) 10^{-9} m (c) 10^{-6} m (d) 10^{-6} mm

76. ________ is the building block of every complex electronic circuit.
(a) semiconductor diode (b) resistor (c) capacitor (d) amplifier

77. Photodiode is used for the detection of: **(2 Times)**
(a) light (b) thermal radiation (c) radio waves (d) sound waves

78. Which component of the transistor has greater concentration of impurity? **(4 Times)**
(a) Base (b) Emitter (c) Collector (d) Both emitter and collector

79. $X = \overline{A . B}$ is the mathematical notation for: **(2 Times)**
(a) NAND gate (b) NOR gate (c) OR gate (d) AND gate

80. The Boolean equation for exclusive NOR gate is given by: **(2 Times)**
(A) $X = AB + BA$ (B) $X = A\bar{B} + \bar{B}A$ (C) $X = A\bar{B} + \bar{B}A$ (D)

81. The Resistance between the inverting (-) and Non-Inverting (+) inputs is called Input Resistance and is of the order of:
(A) Ohms (B) Kilo Ohms (C) Thousands Ohm (D) Mega Ohms

82. Input resistance of op-amplifier is of the order of:
(A) Few ohms (B) Mega ohms (C) Milli ohms (D) Micro ohms

83. Doping is made comparatively larger in:
(A) emitter (B) base (C) collector (D) P-type semi-conductors

84. Conversion of only one half of A.C. into D.C is called:
(A) half wave amplification (B) wave amplification
(C) half wave electrification (D) half wave rectification

85. In n-type substance, minority charge carries are:
(A) electrons (B) holes (C) protons (D) neutrons

2019

86. For normal operation of transistor, the Emitter-Base junction is always:
(A) Forward Biased (B) Reverse Biased (C) Unbiased (D) Grounded

87. If $R_1 = 10$ kΩ and $R_2 = 1000$ kΩ, then gain of inverting amplifier is:
(A) -11 (B) -10 (C) 10 (D) 11

88. A p-n junction cannot be used as: **(2 Times)**
(A) amplifier (B) rectifier (C) detector (D) LED

89. Photo diode can turn its current on and off in:
(A) Micro-sec (B) Nano-sec (C) Pico-sec (D) Femto-sec

90. Photovoltaic cell is formed from:
(A) Arsenic (B) Carbon (C) Germanium (D) Silicon

91. The Resistance between (+) and (-) inputs of Operational Amplifier is:
(A) Very Low (B) Very High (C) Zero (D) Infinity

92. In a comparator circuit, when intensity of light decreases,then resistance or LDR:
(A) R_L increases (B) R_L decreases (C) V_n decreases (D) V. increses

93. The common emitter current amplification foctor β is given by:
(A) $\frac{I_C}{I_E}$ (B) $\frac{I_C}{I_B}$ (C) $\frac{I_E}{I_B}$ (D) $\frac{I_B}{I_C}$

94. The gain of non-inverting amplifier is:
(A) $1+\frac{R_2}{R_1}$ (B) $1+\frac{R_1}{R_2}$ (C) $\frac{-R_2}{R_1}$ (D) $\frac{-R_1}{R_2}$

2021

95. The colour of light emitting diode (LED) depends upon :
(A) The type of semiconductor materal (B) The amount of forward current
(C) Its forward Biasing (D) Its reverse Biasing

96. The voltage gain of a inverting operational amplifier is given by input and output is:
(A) $G=1-\frac{R_2}{R_1}$ (B) $G=1-\frac{R_1}{R_2}$ (C) $G=-\frac{R_1}{R_2}$ (D) $G=-\frac{R_2}{R_1}$

97. Number of diodes used in half wave rectifier is:
(A) 4 (B) 3 (C) 2 (D) 1

98. S.I unit of current gain of transistor is:
(A) Coulomb (B) Ampere (C) Frard (D) No unit

99. Number of Diodes used in Full Wave (bridge) rectifier circuit are:
(A) 4 (B) 3 (C) 2 (D) 1

100. The value of Potential Barrier for Silicon at room temperature is:
(A) 0.3 V (B) 0.5 V (C) 0.7 V (D) 0.9 V

101. The voltage gain of an amplifier having $r_{ie}=1\Omega$, $\beta=100$, $R_c=20\Omega$ is:
(A) 2000 (B) 1000 (C) 500 (D) 5

102. Base of the transistor is very thin of the order of the
(A) $10^{-6}m$ (B) $10^{-2}m$ (C) $10^{-1}m$ (D) $10^{-3}m$

103. The operational amplifier, when works as inverting amplifier. The phase change between its input and output is
(A) 90^{o} (B) 120^{o} (C) 150^{o} (D) 180^{o}

104. The reverse current through a semiconductor diode is due to flow of:
(A) holes (B) electrons (C) majority carriers (D) minority carriers

105. A light emitting diode emits light only when it is:
(A) OFF (B) reverse biased (C) forward biased (D) Unbiased

106. A photodiode can turn its current ON and OFF in:
(A) $10^{-3}s$ (B) $10^{-6}s$ (C) $10^{-9}s$ (D) $10^{-12}s$

107. Forward resistance of the p-n junction is:
(A) Very large (B) Of the order of $k\Omega$ (C) A few Ohms (D) In mega Ohms

108. Which diode is used for detection of light?
(A) Light emitting diode (B) Photo diode
(C) Photo voltaic cell (D) All these

109. The specially designed semi-conductor diode used as indicator lamp in electronic circuit are:
(A) The switch (B) Solar cells
(C) Photodiodes (D) Light emitting diode

110 In Common Emitter Transistor Amplifier the input Signal and Output Signal are always:
(A) Have the same Magnitude (B) Have Same Phase
(C) Out of the Phase by 180^{o} (D) Negative

111. The value of input Resistance of OP-Amplifier is of the order of:
(A) Few Ohms (B) Mili Ohms (C) Kilo Ohms (D) Mega Ohms

112. If R_1 = infinity and $R_2=0$, then gain of non-inverting amplifier is:
(A) 0 (B) 1 (C) 2 (D) Infinity

113. The term transistor Stands for:
(A) Transfer of resistance (B) Transfer of voltage

(C) Transfer of current (D) All of these

ANSWERS OF THE MULTIPLE CHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	B	D	B	A	D	B	D	A	D	D	D	B	A	B	B
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
C	C	C	C	A	C	A	A	B	B	D	B	C	C	D	B
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
C	A	C	D	B	B	C	A	D	D	A	B	A	A	B	C
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
A	B	A	C	C	C	D	A	D	D	C	D	B	B	D	D
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
C	C	D	B	D	C	A	B	D	B	C	D	A	B	D	B
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
A	D	B	A	B	A	B	A	B	D	B	A	B	A	A	D
97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112
D	D	A	C	A	A	D	D	C	C	C	B	D	C	D	B
113															
A															

SHORT QUESTIONS OF CHAPTER-18 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Brief review of PN Junction and its characteristics:

1. What is net charge on a n-type or p-type substances? **(18 Times)**

Ans: Since they are electrically neutral substances. So the net charge on them is zero.

2. How does the motion of an electron in an n-type substance differ from the motion of holes in a p-type substance? **(10 Times)**

Ans: Motion of electrons in n-type substance is more mobile and rapid than holes in p-type substance because electrons do not require holes for their motion but hole depend upon electrons for their motion. Both move in opposite direction.

3. Give four applications (or uses) of a photo diode. **(4 Times)**

Ans: It is used as

i. Detection of both visible and invisible radiations ii. Automatic switching

iii. Logic circuits iv. Optical communication equipment

4. The anode of a diode is 0.2V positive with respect to the cathode. Is it forward biased? **(14 Times)**

Ans: Yes, when anode is $0.2\ V$ positive with respect to cathode, it is forward biased. But the value of potential barrier for germanium is $0.3\ V$ and for silicon is $0.7\ V$. Therefore there will be no conduction of current.

5. What is the potential barrier? What is the value of potential barrier of Si and Ge? **(3 times)**

Ans: The potential difference across the depletion region which acts as a barrier to the flow of charge carriers is called potential barrier.
The value of potential barrier for germanium is $0.3\ V$ and for silicon is $0.7\ V$.

6. What is the effect of forward and reverse biasing of a diode on the width of depletion region? **(8 Times)**

Ans: When forward biased then the width of depletion region decreases and when reverse biased then the width of depletion region increases.

7. Define depletion region. **(2 times)**

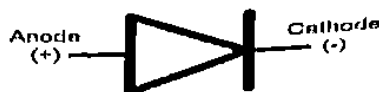
Ans: A region in a semiconductor device, usually at the junction of p-type and n-type materials, in which there is neither an excess of electrons nor of holes is called depletion region. It is a charge less region.

8. How is p-n junction formed?

Ans: A p-n junction is formed when a crystal of germanium or silicon is grown in such

a way that its one half is doped with a trivalent impurity and the other half with a pentavalent impurity.

9. What is semi-conductor diode?

Ans: p-n junction is called semi-conductor diode. The arrow head represents the p-region and is known as anode. The vertical line represents the n-region and is known as cathode.

The current flows in the direction of arrow when the diode is forward biased.

10. Differentiate between forward and reverse biasing. (3 Times)

Ans: (a) When p-side is positive and n-side is negative, the diode is forward biased. The width of depletion region reduces due to which more current is allowed to flow across the junction. The forward resistance is few ohms.

(c) When p-side is negative and n-side is positive, the diode is reversed biased. The width of depletion region is increased and a very small current flows across the junction due to flow of minority charge carriers. The resistance offered by the diode is several mega ohms.

11. Explain why an ordinary Silicon diode does not emit light. (26 Times)

Ans: Ordinary silicon is opaque to light. So it does not emit visible light. It emits infra-red (invisible) light. To emit visible light, gallium arsenide or gallium arsenide phosphide are used as semiconductors.

12. Why charge carriers are not present in the depletion region? (8 times)

Ans: This is due to the fact that when an electron from an n – region diffuses into the p – region, it leaves behind a positive ion. When this electron recombines with the hole in the p – region, a negative ion is formed. So, no charge carriers are available in this region, though it contains immobile positive and negative ions.

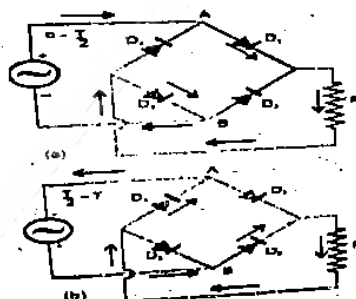
13. How the current flows in forward and reverse biased diode?

Ans: In **forward biasing**, the external potential difference supplies energy to free electrons in n-region and holes in p-region to overcome the potential barrier, a current of the order of a few mili-amperes begins to flow across the pn-junction. In **reverse biasing**, no current flows due to the majority charge carriers. However, a very small current, of the order of few micro-amperes flows across the junction due to minority charge carriers. It is known as reverse current or leakage current.

14. What is the role of potential barrier in a diode? How is it formed in a diode?

Ans: At the formation of p-n junction, the free electrons in n-region because of their random motion diffuse into the p-region. As a result of this diffusion, a region is formed around the junction consisting of positive and negative ions. Due to charge on these ions a potential difference develops across the depletion region. This potential difference called potential barrier, stops further diffusion of electrons into the p-region.

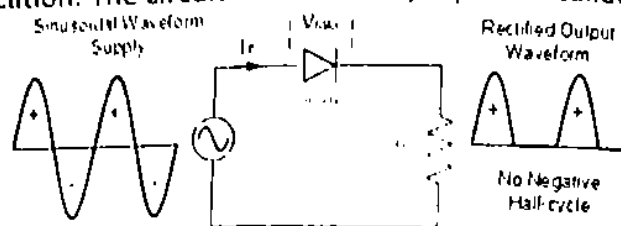
Topic II: Rectification:

15. Draw a circuit used to full wave rectification. Show direction of current in the circuit when positive half of input AC cycle passes through it.

16. What is meant by rectification?

Ans: The conversion of alternating current signal into pulsating direct current signal is

called rectification. The circuit used for this purpose is called rectifier circuit.

17. Define rectification. Draw a circuit diagram of half wave rectifier.

Ans: The conversion of alternating current signal into pulsating direct current signal is called rectification. The circuit used for this purpose is called rectifier.

18. What do you mean by the terms, rectifier and rectification?

Ans: Conversion of alternating current into direct current is called **rectification**. There are tow types of rectification.

(i) Half – wave rectification

(ii) Full – time rectification

The circuit used for rectification is called **rectifier**.

Topic III: Specially Designed P-n Function:

19. Why is the photo-diode operated in reserve biased state? **(21 Times)**

Ans: Photodiode is used for the detection of light. So it is used in reverse biased state. Reverse current increases with the intensity of incident light. When no light incidents, then reverse current will be negligible.

20. What is photo-voltaic cell? Discuss its working. **(2 Times)**

Ans: It consists of a thick n-type region covered by a thin p-type layer. When exposed to light, it absorbs photon which generates electron-hole pairs. The electric field at the junction moves electrons and holes and a current flows through the external circuit. And this current is directly proportional to the intensity of light.

21. What do you know about Photo-voltaic Cell?

Ans: It consists of a thick n-type region covered by a thin p-type layer. When exposed to light, it absorbs photon which generates electron-hole pairs. The electric field at the junction moves electrons and holes and a current flow through the external circuit. And this current is directly proportional to the intensity of light.

22. What is photodiode? Write down its any two applications. **(4 Times)**

Ans: Photodiode is used for the detection of light. It is used in reverse biased state. Reverse current increases with the intensity of incident light. When no light incidents, then reverse current will be negligible. It is used as

i. Detection of both visible and invisible radiations ii. Automatic switching

23. Write a note on LED. OR What is light emitting diode? **(2 Times)**

Ans: Light emitting diodes (LED) are made from special semi-conductors such as gallium arsenide and gallium arsenide phosphide in which the potential barrier between p & n sides is such that when electron combines with a hole during forward biased conduction, a photon of visible light is emitted.

LED's are used in 7 – segment display, small light sources etc.

24. What do LED and LASER stand for?

Ans: **LED** stands for light emitting diode.

LASER stands for light amplification by stimulated emission of radiation.

25. What is solar cell? Give its uses.

Ans: **Solar Cell** is a source of current. It converts sunlight directly into electrical energy. Solar cells are used in calculators, wrist watches, attached with nickel – cadmium batteries to store charge etc.

Topic IV: Transistor:

26. Why the base current in transistor is very small? **(24 Times)**

Ans: Base is very thin so a number of electrons attracted by collector and very few enter into the base. And base current is very small.

That is $I_E = I_B + I_C$

As I_B is very small so it can be neglected $I_E \cong I_C$

Also $V_{BB} << V_{CC}$

27. In a certain circuit, the transistor has a collector current of 20 mA and base current 60 mA. What is the current gain of the transistor?

Ans: Since

$$\beta = \frac{I_C}{I_B}$$

$$\beta = \frac{20\ mA}{60\ mA}$$

$$\beta = 0.34$$

28. A transistor has I_C=10 mA and $I_B = 40\mu A$. Calculate current gain of transistor. (2 Times)

Ans: Since

$$\beta = \frac{I_C}{I_B}$$

$$\beta = \frac{10\ mA}{40\ \mu A}$$

$$\beta = \frac{10 \times 10^{-3}\ A}{40 \times 10^{-6}\ A}$$

$$\beta = 0.25 \times 10^{+3}$$

$$\beta = 250$$

29. What is the biasing requirement of the junctions of a transistor for its normal operation? (2 Time)

Ans: For the normal operation, the base-emitter junction of transistor is forward biased and collector-base junction is reverse biased.

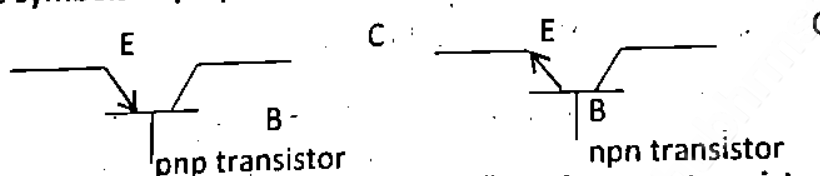
30. How the normal operation of transistor is achieved? (2 times)

Ans: For the normal operation, the base-emitter junction of transistor is forward biased and collector-base junction is reverse biased.

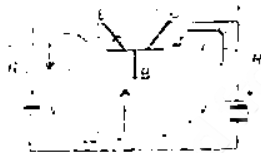
In a common emitter amplifier, input signal is applied between base and emitter and output signal is taken across collector and emitter. Similarly, emitter-base junction is forward biased and collector-base junction is reverse biased.

31. Draw symbols of two types of transistors.

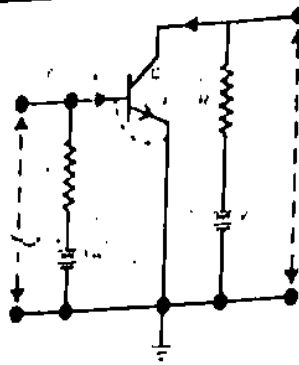
OR Draw the symbols of pmp and npn transistors.

pnp transistor npn transistor

32. Describe by a circuit diagram, how current flows in a npn transistor.

Ans: Emitter – Base junction is forward biased, so emitter injects a large number of electrons in base region. These electrons can flow towards positive terminal of V_{BB} or V_{CC}. Almost all of these free electrons are attracted by the collector due to its large positive potential V_{CC}.

The flow of conventional current is shown in figure below:

33. What is the biasing requirement of the junctions of a transistor for its normal operation? Explain how these requirements are met in a common emitte: amplifier. (2 times)

Ans: For normal operation of a transistor, its emitter – base junction is forward biased and collector – base junction is reversed biased.

In a common emitter amplifier, the battery V_{BB} forward biases the emitter - base junction and V_{CC} reversed biases the collector – base junction as shown in figure.

Topic V: Transistor as an Amplifier:

34. Define current gain of a transistor. Give its mathematical expression and give its unit. (4 Times)

Ans: The ratio of output current to input current is called current gain of a transistor.

Or The ratio of collector current to base current is called current gain of a transistor.

$$\beta = \frac{I_C}{I_B}$$

It has no unit.

Topic VI: Operational Amplifier:

35. Give any two characteristics of an operational amplifier. (9 Times)

Ans: **Input Resistance:** It is the resistance between the (+) and (−) inputs of the amplifier. Whose value is of the order of several mega ohms.

Output Resistance: It is the resistance between the output terminal and ground. Its value is only a few ohms.

36. Define input and output resistance of an operational amplifier. (2 times)

Ans: The resistance between the (+) and(−) inputs of the amplifier is called input resistance. Whose value is of the order of several mega ohms. And The resistance between the output terminal and ground is called output resistance. Its value is only a few ohms.

37. Define Open Loop gain of operational amplifier. Also give its formula. (6 Times)

Ans: The ratio of output voltage to voltage difference between non-inverting and inverting inputs, when there is no external connection between the input and output is called open loop gain of operational amplifier.

$$A_{OL} = \frac{V_o}{V_+ - V_-} = \frac{V_o}{V_i}$$

38. Write briefly about Operational Amplifier.

Ans: The whole amplifier is integrated on a small silicon chip and enclosed in a capsule. Pins connected with working terminals project outside the capsule.

It is some times used to perform mathematical operations electronically. It has two input terminals and a single output terminal. Its open loop gain is very high of the order of 10^5. It is used as inverting amplifier and non – inverting amplifier.

Topic VIII: Op. Amp as Inverting Amplifier:

39. If $R_1 = 10K\Omega$ and $R_2 = 100K\Omega$. Find the gain of inverting operational amplifier.

Ans: Since

$$G = -\frac{R_2}{R_1} = -\frac{100}{10} = -10$$

40. What is the principle of virtual ground? (5Time)

Ans: In an operational amplifier, if the non-inverting terminal is grounded, by the concept of virtual ground, the inverting terminal is also at ground potential, through there is no physical connection between the inverting terminal and the ground. This is the principle of virtual ground.

41. What is the principle of virtual ground? Write the gain of inverting amplifier.

(2 Times)

Ans: In an operational amplifier, if the non-inverting terminal is grounded, by the concept of virtual ground, the inverting terminal is also at ground potential, though there is no physical connection between the inverting terminal and the ground. This is the principle of virtual ground.
The negative sign indicates that output signal is 180° out of phase with respect to input signal.

Topic XIII: Fundamental Logic Gates:

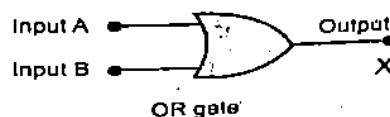
42. Give two applications of gates in control system.

Ans: Gates are widely used in control systems. They control the function of the system by monitoring some physical parameters such as temperature, pressure or some other physical quantity of the system. Sensors are required to operate gates.

(2 Times)

43. What is OR – GATE? Write its relation.

Ans: OR-Gate implements the logic of OR operation. It has two or more inputs and a single output. Its output will be zero only when all the inputs are zero. Its symbol is shown below

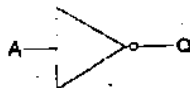
OR gate

Its relation is given as

$$X = A + B$$

44. The inputs of a gate are I and 0, identify the gate if its output is (a) 0, (b) 1.

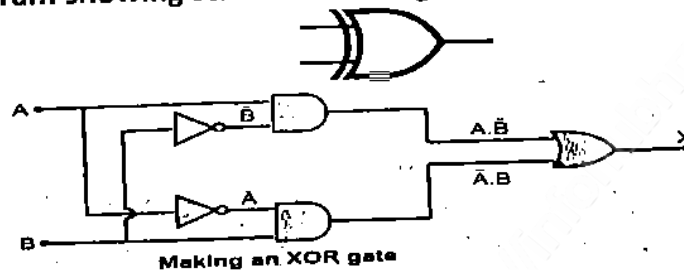
Ans: According to the given conditions

Inputs	*Output*		*Gate*
1	0	1	*OR*
1	0	0	*AND*

45. Draw the symbolic diagram of Not gate and write its truth table. (2 times)

And its truth table is

Input	*Output*
0	1
1	0

46. Draw a diagram showing scheme of XOR gate.

Making an XOR gate

47. Draw the symbolic diagram of OR gate and write its truth table. (2 times)

Ans: Symbolic diagram of OR Gate is

OR gate

And its truth table is

A	B	$X = A + B$
0	0	0
0	1	1
1	0	1
1	1	1

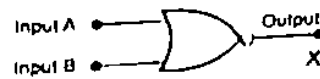
48. What is the mathematical expression of AND gate? Write its truth table.

Ans: Symbolic diagram of AND Gate is

And its truth table is

A	B	$X = A.B$
0	0	0
0	1	0
1	0	0
1	1	1

49. Draw the symbol and truth table of NOR gate.

Ans: Symbolic diagram of NOR Gate is

And its truth table is

A	B	$X = \overline{A+B}$
0	0	1
0	1	0
1	0	0
1		0

50. Draw the symbol and truth table of NAND gate: **(2 Times)**

Ans: Symbolic diagram of NAND Gate is

And its truth table is

A	B	$X = \overline{A.B}$
0	0	1
0	1	1
1	0	1
1	1	0

51. Write down symbol and truth table of exclusive NOR gate.

Ans: Symbolic diagram of XNOR Gate is

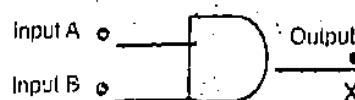
And its truth table is

A	B	$X = \overline{A.\bar{B} + \bar{A}B}$
0	0	1
0	1	0
1	0	0
1	1	1

52. What is AND gate? Write its truth table.

Ans: It is a logic gate that implements the truth table of AND operation. It has two or more inputs and single output.

Mathematical notation $X = A . B$

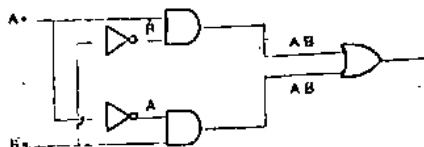
Symbol :

Truth Table:

Inputs		Output
A	B	X
0	0	0
0	1	0
1	0	0
1	1	1

53. **Define digital system and logic gates.**

Ans: A digital system deals with quantities or variables which have only two discrete values or states.
The electronic circuits which implement the various logic operations are known as logic gates.

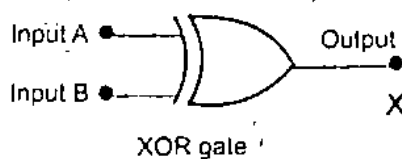
54. **Draw diagram of exclusive OR Gate and write its formula.**

Ans:

Formula of exclusive OR Gate:

$Y=\bar{A}.B+A.\bar{B}$

55. **How is the XOR gate so called? Draw its symbol.**

Ans: One of its most commonly used applications is as a basic logic comparator which produces a logic "1" output when its two input bits are not equal. Because of this, the XOR gate has an inequality status being known as an odd function.

Input A, Input B, Output X

XOR gate

56. **Draw symbol of exclusive OR Gate and write its truth table.**

Ans:

Input A, Input B, Output X

XOR gate

Inputs		Output
A	B	X
0	0	0
0	1	1
1	0	1
1	1	0

57. **How gates are used in controlling systems?**

Ans: Gates control the function of the system by monitoring some physical parameter such as temperature pressure or some other physical quantity of the system. As gates operate with electrical voltage only, so sensors are used to convert physical quantities into electric voltage.

58. **Draw the truth table of XNOR Gate.**

Ans:

Input A	Input B	Output X
0	0	1
0	1	0
1	0	0
1	1	1

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59. What is light emitting diode? Give its applications.

Ans: Light emitting diodes (LED) are made from special semi-conductors such as gallium arsenide and gallium arsenide phosphide in which the potential barrier between p and n sides is such that when electron combines with a hole during forward biased conduction, a photon of visible light is emitted.

i. It is used as small light source as indicator.

ii. A specially array of LEDs for displaying digits in electronic devices which is called seven segment displays.

iii. They are used in calculators and digital watches.

60. Describe the variation of size and the difference in concentration of impurity in different parts of a transistor.

Ans: The central region of transistor is known as base which is very thin of the order of 10^{-6} meter. The thicker regions on either side of the base are called emitter and collector. The emitter and collector have greater strength of impurity. The collector is comparatively larger than emitter. The emitter has greater concentration of impurity as compare to collector.

61. What is the working principle of a light emitting diode?

Ans: A light-emitting diode is a forward biased p-n-junction diode that emits (visible) light when energized. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons.

62. What is rectification? Write its two types.

Ans: <u>Rectification:</u> The conversion of alternating current (AC) signal into pulsating direct current (DC) signal is called rectification. The circuit used for this purpose is called rectifier circuit. There are two very common types of rectification:

i) Half wave rectification: Such type of rectification in which only half of input AC is converted into DC is called half wave rectification.

ii) Full wave rectification: Such type of rectification in which both input cycles of AC are converted into DC is called full wave rectification.

63. Why does light emitting diode emit visible light?

Ans: Because light emitting diodes (LED) are made from special semi-conductors such as gallium arsenide and gallium arsenide phosphide in which the potential barrier between p and n sides is such that when electron combines with a hole during forward biased conduction, a photon of visible light is emitted.

LONG QUESTIONS OF CHAPTER-18 IN ALL PUNJAB BOARDS 2011-2021

Topic I: P-N Junction:

1. What is P-n junction? How it is forward and reverse biased? Draw circuit and give characteristics. **(2 times)**

Topic II: Rectification:

2. Define rectification and describe the working of half-wave and a full-wave rectifier.
3. Define rectification. What are its types? Discuss half wave rectification. **(4 times)**
4. Define rectification. Write a note on full wave rectification with diagram. **(4 times)**

Topic IV: Transistor:

5. Describe the flow of current in n-p-n transistor with the help of circuit diagram. Define current gain of a transistor.
6. Define depletion region, barrier potential and transistor. Discuss current through n-p-n transistor.

Topic V: Transistor as an Amplifier:

7. What is a transistor? Describe the use of transistor as an amplifier and calculate its voltage gain. **(13 Times)**
8. How can we use a transistor as an amplifier?

Topic VI: Operational Amplifier:

8. What is operational amplifier? Discuss the action of op amp as inverting and non-inverting amplifier. **(6 Times)**
9. What is operational amplifier? Describe operational amplifier as inverting amplifier. **(4 Times)**
10. Define inverter. Describe the working of operational amplifier as inverting amplifier.

Topic IX: OP-AMP as Non-Inverting Amplifier:

11. Draw the circuit diagram of non-inverting amplifier and label it. Evaluate the relations for its gain. **(7 Times)**

Topic XIII: Fundamental Logic Gates:

12. Draw the symbols of logic gates for the following Boolean functions.
    (i) $X = \overline{A + B}$ (ii) $X = \overline{A.B}$
    Write their respective truth tables.
13. What are logic gates? Describe fundamental logic gates in detail.
14. What are logic gates? Discuss the OR Gate and AND Gate.
15. What is the digital system? Explain OR and AND gates with diagrams and truth tables.

NUMERICAL PROBLEMS OF CHAPTER-18 IN ALL PUNJAB BOARDS 2011-2021

Topic IV: Transistor:

1. **The current following into the base of a transistor is $100\,\mu A$. Find its collector current I_C, emitter current I_E and its ratio $\frac{I_C}{I_E}$ if the value of current gain $\beta = 100$.**

(15 Times)

Ans:

Given that $I_B = 100\ \mu A = 100 \times 10^{-6}\ A$

$$\beta = 100$$
$$I_C = ?$$
$$I_E = ?$$
$$\frac{I_C}{I_E} = ?$$

Since

$$\beta = \frac{I_C}{I_B}$$
$$I_C = \beta I_B$$
$$I_C = (100)(100 \times 10^{-6})$$
$$I_C = 10^{4-6}\ A$$
$$I_C = 10^{-2}\ A$$
$$I_C = 10^{-2+3-3}\ A$$
$$I_C = 10 \times 10^{-3}\ A$$
$$\boxed{I_C = 10\ mA}$$

And

$$I_E = I_C + I_B$$
$$I_E = 10\ mA + 100\ \mu A$$
$$I_E = 10 \times 10^{-3} + 10 \times 10^{-6}$$
$$= 10.01 \times 10^{-3}\ A$$
$$\boxed{I_E = 10.01\ mA}$$

And

$$\frac{I_C}{I_E} = \frac{10}{10.01} \boxed{= 0.99}$$

2. **In a certain circuit, the transistor has a collector current if $10\ mA$ and base current of $40\ \mu A$. What is the current gain of the transistor? (9 Times)**

Ans: Given that $I_C = 10\ mA = 10 \times 10^{-3}\ A$

$$I_B = 40\ \mu A = 40 \times 10^{-6}\ A$$
$$current\ gain = \beta = ?$$

Since

$$\beta = \frac{I_C}{I_B}$$
$$\beta = \frac{10 \times 10^{-3}}{40 \times 10^{-6}}$$
$$\boxed{\beta = 250}$$

3. **What is current gain of a transistor if it has a collector current of 10 mA and a base current of 40 µA.**

Ans: Since

$$\beta = \frac{I_C}{I_B}$$
$$\beta = \frac{10\ mA}{40\ \mu A}$$
$$\beta = \frac{10 \times 10^{-3}\ A}{40 \times 10^{-6}\ A}$$
$$\beta = 0.25 \times 10^{+3} = 250$$

Q. 4 **In the circuit shown in figure, there is negligible potential drop between B and E. Calculate** **(3 Times)**

(i) Base current **(ii) Potential drop across Rc**

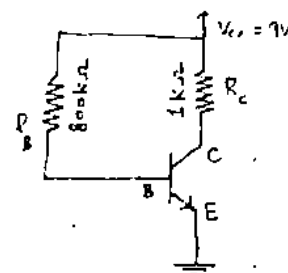
(iii) V_{CE} ($\beta = 100$)

$V_{cc} = 9V$

$R_B = 800K\Omega = 800 \times 10^3\Omega$

$R_c = 1\ K\Omega 10^3\Omega$

V_{BE}=0 , β = 100

$I_B = ?$, $V_c = ?$, $V_{CE} = ?$

Applying Kirchhoff's voltage Rule

$$V_{CC} - I_B R_B - V_{BE} = 0$$

$$V_{CC} - I_B R_B - 0 = 0$$

$$V_{CC} = I_B R_B$$

$$I_B = \frac{V_{CC}}{R_B} = \frac{9}{800 \times 10^3} = 11.25 \times 10^{-6} A = 11.25\ \mu A$$

As $V_C = I_C R_c = \beta I_B R_C$ $(\because I_C = \beta I_B)$

$$= (100)(11.25 \times 10^{-6})(10^3) = 1.125V$$

Again Appling Kirchhoff's voltage rule.

$$V_{CC} - I_C R_C - V_{CE} = 0$$

$$V_{CE} = V_{CC} - I_C R_C = 9 - 1.125 = 7.875V$$

Topic IX: Op- amp as a non-inverting amplifier:

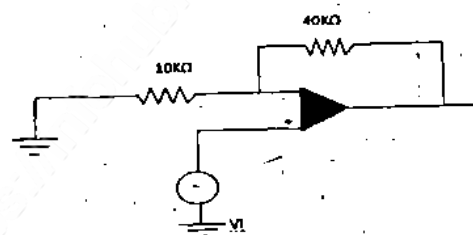
5. Calculate the gain of non-inverting amplifier shown in fig. **(3 Times)**

Sol:

$R_1 = 10K\Omega = 10 \times 10^3\Omega$

$R_2 = 40K\Omega = 40 \times 10^3\Omega$

Gain = ?

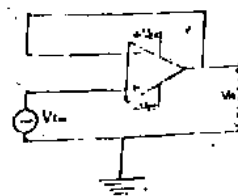
$$Gain = 1 + \frac{R_2}{R_1} = 1 + \frac{40 \times 10^3}{10 \times 10^3} = 1 + 4 = 5$$

6: Find the gain of the circuit shown in figure

Ans: Input signal V_{in} is connected to non-inverting input, so the operational amplifier is acting as a non-inverting amplifier.

Comparing it with the circuit of non-inverting amplifier, we get

$R_1 = \infty$

$R_2 = 0$

Thus $Gain = 1 + \frac{R_2}{R_1} = 1 + \frac{0}{\infty} = 1 + 0 = 1$

OBJECTIVES (MCQ'S) OF CHAPTER-19 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Relative Motion:

1. Rest mass energy of electron is: (4 times)
(A) 1.02 MeV (B) 0.51 MeV (C) 931 MeV (D) MeV

2. The rest mass of photon is: (8 times)
(A) Zero (B) Very small (C) Equal to mass of electron (D) Infinite

3. All motions are: (2 Times)
(A) Absolute (B) Uniform (C) Relative (D) Variable

4. The mass of object will be doubled at speed.
(A) 2.6×10^8 m/s (B) 1.6×10^8 m/s (C) 3.6×10^8 m/s (D) 0.6×10^8 m/s

Topic II: Frame of Reference:

5. The coordinate system in which law of inertia is valid is called:
(A) Special frame of reference (B) Inertial frame of reference
(C) Non-inertial frame of reference (D) Standard frame of reference

Topic III: Special Theory of Relativity:

6. The units of Plank's constant is same as that of: (3 times)
(A) Energy (B) Power (C) Angular frequency (D) Angular momentum

7. The value of Plank's constant h is equal to: (2 Times)
(A) $6.63\times10^{-34}\ js$ (B) $6.63\times10^{-30}\ js$ (C) $6.63\times10^{-31}\ js$ (D) $6.63\times10^{34}\ js$

8. Unit of Plank's constant is: (7 times)
(A) Volt (B) Js (C) $J.S^{-1}$ (D) e.v

9. If object moves with speed of light, its mass become: (2 times)
(A) Zero (B) Infinity (C) Same (D) Small

10. Which of the following wave do not travel with the speed of light:
(A) Radio waves (B) Heat waves (C) X-rays (D) Sound waves

11. The velocity at which the mass of a body become double is:
(A) $\frac{\sqrt{3}}{2}c$ (B) $\frac{2}{\sqrt{3}}c$ (C) $\frac{\sqrt{3}}{4}c$ (D) C

12. The special theory of relativity based on:
(A) 1 postulate (B) 2 postulates (C) 3 postulates (D) 4 postulates

13. The dimensions of Planck's Constant are same as that of:- (2 times)
(a) Energy (b) Power (c) Acceleration (d) Angular Momentum

14. The theory of relativity was propsed by:
(A) Newton (B) Maxwell (C) Compton (D) Einstein

15. If an object moves with speed of light, its mass will be:
(A) Zero (B) Maximum (C) Minimum (D) Infinity

16. In 1905, the special theory of relativeity was proposed by:
(A) Einstein (B) Bohr (C) Maxwell (D) De Broglie

17. Joule – second is the unit of: (3 times)
(A) Energy (B) Heat (C) Planck's Canstant (D) Work

Topic IV: Black Body Radiation:

18. At low temperature a body usually emits radiation of: (2 times)
(A) Long wavelength (B) Short wavelength (C) Infinite wavelength (D) None of these

19. Platinum wire becomes yellow at temperature of: (2 times)
(A) $900°C$ (B) $1300°C$ (C) $1600°C$ (D) $500°C$

20. Momentum of moving photon is given by: (2 times)
(A) hc/λ (B) h/λ (C) h / f (D) $h\lambda/c$

21. An atom can reside in excited state for: (2 times)
(A) 10^{-8} sec (B) One second (C) 10^{-3} sec (D) 10^{-10} sec

22. In Stephen-Boltzmann's law $E = \sigma T^4$, the σ is called:
(A) Plank's constant (B) Stephen-Boltzmann's constant

(C) Stephen's constant (D) Boltzmann's constant

23. The value of Stefan's constant is: (3 times)

(A) 5.67×10^{-6} wm^{-2}k^{-4} (B) 5.67×10^{-10}wm^{-2}k^{-4}
(C) 5.67×10^{-8}wm^{-2}k^{-4} (D) 5.67×10^{-4}wm^{-2}k^{-4}

24. Energy of black body radiations depends upon:

(A) Nature of surface of body (B) Nature of material body
(C) Shape and size of body (D) Temperature of the body

25. According to Stefan's Law about black body radiations is:

(A) $E \propto \frac{1}{T^2}$ (B) $E \propto T^2$ (C) $E \propto T^4$ (D) $E \propto T$

26. When platinum wire is heated it appears cherry red at temperature: (2 times)

(A) 500 °C (B) 900 °C (C) 1100°C (D) 1300 °C

27. The platinum wire becomes white at a temperature of: (2 times)

(A) 1600°C (B) 1100°C (C) 1000°C (D) 600°C

28. When Platinum is heater, it becomes orange at: (3 times)

(a) 500^0C (b) 900^0C (c) 1100^0C (d) 1300^0C

29. Potassium cathode in photocell emits electrons for a light:

(a) Visible (b) Infra-red (c) Ultra violet (d) X-rays

30. The energy of Photon is given by: (2 times)

(A) $\frac{mv^2}{2}$ (B) hf (C) $V_o e$ (D) $V_o e^2$

31. The frequency of a Micro – Wave with Wavelength 10 cm can be:

(A) 300 KHz (B) 300 μ Hz (C) 3×10^9 Hz (D) 30KHz

Topic V: Interaction of Electromagnetic Radiation with Matter:

32. The Compton shift in wavelength will be maximum when angle of scattering is: (4 times)

(A) 30° (B) 45° (C) 90° (D) 180°

33. The pair production is also called:

(A) Pair annihilation (B) Materialization of energy (C) Fusion reaction (D) Fission

34. The factor $h/m_o c$ in Compton equation has the dimensions of: (7 times)

(A) Pressure (B) Length (C) Mass (D) Momentum

35. Each photon is associated with radiation of:

(A) Intensity (B) Frequency (C) Resistance (D) Momentum

36. Photoelectric current depends on:

(A) Frequency of light (B) Intensity of light (C) Speed of light (D) Polarization of light

37. Compton Effect observed with:

(A) X-rays (B) Visible light (C) Radio waves (D) All of these

38. Compton shift is equal to Compton wavelength when the scattered x-rays photons are observed at an angle of: (2 times)

(A) 0° (B) 30° (C) 60° (D) 90°

39. An elect.ic eye operates because of:

(A) Compton effect (B) Photo refraction (C) Photo electric effect (D) I R-radiations

40. Maximum kinetic energy of photoelectrons depend upon ____ of incident light:

(A) Frequency (B) Intensity (C) Brightness (D) Power

41. Compton shift is equal to Compton wavelength when the scattered x-rays photons are observed at an angle of: (2 times)

(A) 0° (B) 30° (C) 60° (D) 90°

42. The amount of energy required to eject an electron from metal surface is called:

(A) Threshold frequency (B) Work function (C) Pair production (D) Compton Effect

43. Production of x-rays can be regarded as the reverse phenomenon of: (2 times)

(A) Pair production (B) Photoelectric effect (C) Compton Effect (D) Annihilation effect

44. The maximum energy needed for a photon to create an electron-positron pair is: (2 Times)

(A) 1.02 Kev (B) 0.51 Kev (C) 0.51 Mev (D) 1.02 Mev

45. In photoelectric effect, If we increase the frequency of the incident light then ___ of electrons increased:
(A) Number (B) K.E (C) P.E (D) Frequency

46. The condition $hf > 2m_oc^2$ refers to:
(A) Compton Effect (B) Pair production (C) Photoelectric effect (D) Annihilation of matter

47. The number of electrons emitted depends upon:
(A) Colour of target surface (B) Shape of surface
(C) Frequency of incident light (D) Intensity of incident light

48. At higher energies more than 1.02 Mev the dominant process is: **(3 Times)**
(A) Photoelectron effect (B) Compton Effect (C) Pair production (D) Nuclear fission

(2 times)
49. The unit of work function is:
(A) eV (B) Volt (C) Farad (D) Hertz

50. The change in wavelength of scattered photon in Compton effect is:
(A) $\frac{h}{m_0c}$ (1-cos θ) (B) $\frac{h}{m_0c^2}$(1-cos θ) (C) $\frac{m_0}{hc}$ (1 - cos θ) (D) $\frac{h}{m_0^2c^2}(1 - \cos\theta)$

51. Compton's shift in Wave Length of ($\Delta\lambda$) is zero, when scattered angle of photon is:
(A) 90° (B) 180° (C) 0° (D) 45°

52. Compton Effect proves:
(A) Wave nature of radiation (B) Wave nature of particle
(C) Dual nature of particle (D) Particle nature of radiations

53. Disintegration of photon on striking a nucleus into an electron and positron is:
(A) Annihilation of matter (B) Compton effect
(C) Pair production (D) Photo electric effect

54. Two Photons approach each other, their relative speed will be:-
(a) 2 c (b) zero (c) less than c (d) c

55. Antiparticle of electron is:
(a) Proton (b) photon (c) neutron (d) positron

56. In order to increase the K.E of ejected photo electrons there should be an increase in: **(2 times)**
(a) Intensity of radiations (b) wavelength of radiations
(c) Frequency of radiations (d) both as b and c

57. Compton's effect is associated with:
(a) Gamma rays (b) beta rays (c) x-rays (d) positive rays

58. The rest mass energy of an electron positron pair is:
(a) 0.51 MeV (b) 1.02Mev (c) 1.2 MeV (d) 1.00 MeV

59. Production of X-rays is reverse process of:
(a) Photo-electric effect (b) Compton Effect (c) Annihilation (d) Pair production

60. The momentum of photon is given by:
(a) P=mv (b) P=$\frac{h}{\lambda}$ (c) P=$\frac{\lambda}{h}$ (d) P=h λ

61. Energy of each positron is given by:
(a) 2 MeV (b) 1.02 MeV (c) 0.51 MeV (d) 5 MeV

62. Pair production can take place only when energy of radiation is equal and greater than 1.02 MeV, thus correct option is:
(A) X- Rays (B) Heat radiation (C γ -rays (D) Ultrviolet Rays

63. The existence of Positron in 1928 was predicted by:
(A) Anderson (B) Dirac (C) Chadwick (D) Plank

64. The maximum Kinetic energy of emitted photoelectrons depends upon:
(A) the intensity of incident light (B) frequency of the incident light
(C) metal surface (D) both frequency of indident light and metal surface

65. The reverse process of photo – electric effect is called:
(A) Pair production (B) Compton effect (C) Annihilation of matter (D) X – Rays

66. Who explained the photo electric effect?
(A) Max plank (B) Einstein (C) Henry (D) Rutherford

Topic VI: Annihilation of matter:

67. The inverse of pair production is:
(A) Hertz effect (B) Compton Effect (C) Black body (D) Annihilation of matter

68.1 Kg mass will be equivalent to Energy: (3 times)
(A) 9×10^8 J (B) 9×10^{12} J (C) 9×10^{16} J (D) 9×10^{17} J

69. When an electron combines with a positron, we gain.
(A) One photon (B) three photons (C) two photons (D) four photons

70. In annihilation, emitted photons move in opposite directions to conserve.
(A) Mass (B) Charge (C) Energy (D) Momentum

Topic VII: Wave Nature of Particles:

71. Wave length 'λ' associated with the particle of mass m and moving with the velocity 'v' is:
(A) $\frac{mv}{h}$ (B) $\frac{hv}{m}$ (C) $\frac{h}{mv}$ (D) $\frac{m}{hv}$

72. Davisson and Germer indicates______ in their experiment:
(A) Electron reflection (B) Electron polarization
(C) Electron refraction (D) Electron diffraction

73. The principle regarding the dual nature of light was first discovered by:
(A) Campton (B) J.J Thomson (C) De-Broglie (D) Heisenberg

74. Which one experiment is the verification of wave nature of particle:
(A) Photo electric (B) Compton effect
(C) Pair production (D)Davisson and Germer exp.

75. We can find from de Broglie formula:
(A) Wavelength (B) Amplitude of wave (C) Speed of wave (D) Frequency of wave

76. Wave nature of light appears in: (2 times)
(A) Pair production (B) Compton Effect (C) Photo electric effect (D) interference

77.______ has the largest de Broglie wavelength at same speed.
(a) Proton (b) $\alpha-$ particle (c) Carbon Atom (d) Electron

78. If a Particle of mass "m" is moving with speed "v" then de – Broglie Wavelength λ associated with it will be:
(A) $\lambda = \frac{3h}{mv}$ (B) $\lambda = \frac{2h}{mv}$ (C) $\lambda = \frac{h}{mv}$ (D) $\lambda = \frac{h}{2mv}$

79. X – ray diffraction reveals that these are:
(A) Paticle type (B) Wave type (C) Bothawave and particle (D) None of above

Topic VIII: Uncertainty Principle:

80. For a nucleus Δx is given as 1.0×10^{-14} m. If the electron remain inside the nucleus then its vibrational velocity should be:
(A) Less than the speed of light (B) Equal to the speed of light
(C) Greater than the speed of light (D) Double than the speed of light

81. Using relativistic effects the location of an air craft after an hour's flight can be predicted about:
(a) 20 m (b) 50 m (c) 760 m (d) 780 m

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82. Application of wave nature of particle is:
(a) photodiode (b) simple microscope (c) compound microscope (d) electron microscope

83. The physical quantity related to photon, that does not change in Compton scattering is:
(a) Energy (b) Speed (c) Frequency (d) Wavelength

84. When a metal is heated sufficiently electrons are given off by the metal. This phenomenon is known as:
(a) photoelectric effect (b) Piezo electric effect
(c) Thermionic emission (d) Secondary emission

85. Compton shift in the wavelength will be minimum when angle of scattering is:
(A) 90^0 (B) 60^0 (C) 30^0 (D) 0^0

86. Amount of energy released due to complete conversion of 1 Kg mass into energy is: (2 times)
(A) 9×10^{16}J (B) 9×10^{9}J (C) 9×10^{20}J (D) 3×10^{8}J

87. Which one is low energy photon:
(A) Visible light (B) Infrared light (C) Ultra violet light (D) X-rays

88. The maximum K.E. of Photoelectron depends upon:
(A) Intensity of Incident Light (B) Frequency of Incident Light
(C) Metal (D) Temp. of Metal

89. the materialization of energy takes place in the process of: (2 times)
(A) Photoelectric Effect (B) Compton Effect
(C) Pair Production (D) Annihilation of Matter

90. The speed of earth around its orbit is:
(A) 10km/s (B) 20 km/s (C) 25 km/s (D) 30 km/s

91. Light of 4.5ev is incident on a cesium surface and stoping potential is 0.25 V, maximum K.E of emitted electrons is:
(A) 4.5 ev (B) 4.25 ev (C) 4.75 ev (D) 0.25 ev

92. The value of palnk's constant is:
(A) 8.85×10^{-34}Js (B) 1.6×10^{-19}Js (C) 6.63×10^{-34}Js (D) 6.62×10^{-23}Js

93. By modern system of NAVSTAR, the speed anywhere on the earth can be determined to accuracy about:
(A) $20ms^{-1}$ (B) $10ms^{-1}$ (C) $2Cms^{-1}$ (D) $2ms^{-1}$

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94. The life time of an electron in an excited state is about 10^{-8}s. What is its uncertainty in energy during this time:
(A) 6.63×10^{-34}J (B) 9.1×10^{-31} J (C) 1.05×10^{-26}J (D) 7.2×10^{-15} J

95. If temperature is doubled for a black body, then energy radiated per second per unit area becomes:
(A) $\frac{1}{2}$ times (B) $\frac{1}{4}$ times (C) $\frac{1}{16}$ times (D) 16 times

96. The wave-length of emitted radiation of maximum intensity is inversely proportional to the absolute temperature. This is known as:
(A) Faraday's law (B) Rayleigh Jean's law
(C) Stefan's law (D) Wien's displacement law

97. Photoelectric effect shows.
(A) Corpuscular nature of light (B) Dual nature of light
(C) Electromagnetic nature of light (D) Wave nature of light

98. In an expression for Time Dilation the quantity $\sqrt{1-\frac{v^2}{c^2}}$ is always:
(A) Equal to Zero (B) Greater than One (C) Equal to One (D) Less than One

99. In the process of Annihilation of Matter, the two Photons produced move in opposite direction to conserve:
(A) Energy (B) Mass (C) Momentum (D) Charge

100. The most refined from of Matter by de-Broglie is:
(A) Smoke (B) Fog (C) Light (D) Protons

101. Compton wavelength is: **(2 times)**
(A) $\frac{h}{m_oc^2}$ (B) $\frac{hc}{m_o}$ (C) $\frac{h}{m_oc}$ (D) $\frac{hc}{m_o\lambda}$

102. The energy required for pair production is: **(2 times)**
(A) 0.51 MeV (B) 1.02 MeV (C) 2.04 MeV (D) 3.06 MeV

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103. The value of Wein's constant is :
(A) $2.9\times10^{3}\ mK$ (B) $2.9\times10^{-3}\ mK$ (C) $2.9\ mK$ (D) $2.9\times10^{-2}\ mK$

104. A photon of Radio wave has an energy of the order of:
(A) $10^{-16}\ eV$ (B) $10^{-10}\ eV$ (C) $1\ eV$ (D) $1\ KeV$

105. When a photon collide with an electron, which of following of photon increase.
(A) Frequency (B) Energy (C) Wave Length (D) Mass

106. Which of the following explain particle nature of light?
(A) Interference (B) Diffraction
(C) Photoelectric effect (D) Polarization

107. Which properties of radio waves are predominate?

(A) Wave (B) Particle (C) Partial wave (D) Partial particle

108. Momentum of photon is given by:

(A) $\frac{h\lambda}{c}$ (B) $\frac{f\lambda}{c}$ (C) $\frac{hf}{c}$ (D) $\frac{hf}{\lambda}$

109. Albert Einstein was awarded Noble Prize in Physics in:

(A) 1905 (B) 1911 (C) 1918 (D) 1921

110. A gamma radiation has an energy of the order of:

(A) 1 MeV (B) 1 KeV (C) 100 eV (D) 1 eV

111. Threshold wavelength for metal having work function ϕ_o is λ_o. What is threshold wavelength for metal having work function 2 ϕ_o is?

(A) $\frac{\lambda}{2}$ (B) 4λ (C) 2λ (D) $\frac{\lambda}{4}$

112. In order to increase the stopping potential of ejected photoelectrons, there should be an increase in:

(A) Intensity of Radiation (B) Wavelength of Radiation

(C) Frequency of Radiation

(D) Both wavelength of Radiation and Intensity of Radiation

113. In the equation $\Delta\lambda = \frac{h}{m_o c}(1-\cos\theta)$ which factor is called Compton wavelength:

(A) $\frac{h}{m_o c}$ (B) $\frac{1}{m_o c}$ (C) $1-\cos\theta$ (D) $\frac{h}{m_o c}(1-\cos\theta)$

114. In photoelectric effect if the intensity of light is made twice than initial value. The maximum K.E of photoelectron becomes:

(A) Same (B) Double (C) Half (D) Four times

ANSWERS OF THE MULTIPLECHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
B	A	C	A	B	D	A	B	B	D	A	B	D	D	D	A
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
C	A	B	B	A	C	C	D	C	B	A	C	A	B	C	D
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
B	B	B	B	A	D	D	A	D	B	B	D	B	B	D	C
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
A	A	C	D	C	A	D	C	C	B	A	B	C	C	B	D
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
D	A	D	C	C	D	C	D	C	D	A	D	D	C	C	C
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
B	D	B	C	D	A	B	B	C	D	D	C	C	C	D	D
97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112
A	D	C	C	C	B	B	B	C	C	A	C	D	A	A	C
113	114														
A	A														

SHORT QUESTIONS OF CHAPTER-19 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Relative Motion:

1. **The rest mass of photon is zero. Is its momentum also zero?**

Ans: No.
The rest mass of photon is zero. It travels in the form of small energy packets which are of equal wavelength. When it is in motion, it possesses some mass. So it will also have momentum.

Topic II: Frame of Reference:

2. **A satellite is orbiting around earth. Is its frame of reference inertial or non-inertial? Justify your answer.**

Ans: The motion of the satellite is synchronized with the earth so it is in the same frame of reference in which earth lies. Hence the frame of reference will be inertial.

3. **If you are moving in a spaceship at very high speed relative to the earth. Would you notice a difference (a) In your pulse rate (b) In the pulse rate of people on the earth?**

Ans: Since $f = \frac{1}{T}$

i. The pulse rate of the person inside the spaceship moving with large velocity will decrease.
ii. The pulse rate of the people on the earth with respect to the person inside the spaceship with large velocity will increase.

4. **Differentiate between inertial and non-inertial frame of reference. (2 Time)**

Ans: A coordinate system in which the law of inertia is valid is called inertial frame of reference. It is non-accelerated frame of reference.
And A coordinate system in which the law of inertia is not valid is called non-inertial frame of reference. It is accelerated frame of reference.

Topic III: Special Theory of Relativity:

5. **What are the measurements on which two observers in relative motion will always agree upon? (6 Times)**

Ans: Two observers in relative motion will always agree upon
i. Force ii. Acceleration

6. **Give two postulate of special theory of relativity. (2 times)**

Ans: Postulates of special theory of relativity are stated as
i. The laws of physics are the same in all inertial frames.
ii. The speed of light in free space has the same value for all observers, regardless of their state of motion.

7. **Find the mass 'm' of moving object with speed 0.8c. (2 times)**

Ans: Given that

$$v = 0.8\,c$$
$$m = ?$$

Since

$$m = \frac{m_o}{\sqrt{1-\frac{v^2}{c^2}}}$$

$$m = \frac{m_o}{\sqrt{1-\frac{(0.8\,c)^2}{c^2}}}$$

$$m = \frac{m_o}{\sqrt{1-(0.8)^2}} \boxed{= 1.67\,m_o}$$

8. **What are advantages of NAVSTAR navigation system?**

Ans: NAVSTAR is used to locate the position and find the speed of any object anywhere on Earth up to an accuracy of 2 cms^{-1}.

9. **If the speed of light was infinity, what would the equations of special theory of relativity reduce to? (7 times)**

Ans: If

$$c \to \infty$$

Then

$$\frac{v^2}{c^2} = \frac{v^2}{\infty} = 0$$

So $t = \frac{t_o}{\sqrt{1-\frac{v^2}{c^2}}} = t_o$

$$l = l_o\sqrt{1-\frac{v^2}{c^2}} = l_o$$

$$m = \frac{m_o}{\sqrt{1-\frac{v^2}{c^2}}} = m_o$$

Thus there will be no change produced due to relative motion.

10. **Can an object move with speed of light? Explain.** **(2 times)**

Ans: As an object approaches the speed of light, its mass rises abruptly. If an object tries to travel 186,000 miles per second, its mass becomes infinite, and so does the energy required to move it. For this reason, no normal object can travel as fast as or faster than the speed of light.

11. **A body is moving with the velocity of 0.95c. Find the value of** $\sqrt{1 - v^2 / c_2}$

Ans: As

$$\sqrt{1-\frac{v^2}{c^2}} = \sqrt{1-\frac{(0.95\,c)^2}{c^2}}$$

$$\sqrt{1-\frac{v^2}{c^2}} = \sqrt{1-(0.95)^2}$$

$$\sqrt{1-\frac{v^2}{c^2}} = \sqrt{1-0.9025}$$

$$\sqrt{1-\frac{v^2}{c^2}} = \sqrt{0.0975}$$

$$\sqrt{1-\frac{v^2}{c^2}} = 0.3122$$

12. **Does the dilation mean that time really passes more slowly in moving system or that it only seems to pass more slowly. Explain briefly.** **(2 times)**

Ans: According to dilation formula $t = \frac{t_o}{\sqrt{1-V^2/C^2}}$

This relation shows that a clock moving with respect to an observer appears to move slow than it does when it is at rest with respect to him. So the moving clocks just appear to run slowly to the observer at rest. Hence, time dilation is an apparent change and it only seems to pass more slowly but not actually.

13. **Define special theory of relativity and write its postulates.**

OR **State the postulates of special theory of relativity.**

Ans: The special theory of relativity deals with the problems involving non-accelerated frames of reference.

Postulates of special theory of relativity are stated as

The laws of physics are the same in all inertial frames.

The speed of light in free space has the same value for all observers, regardless of their state of motion.

14. **Differentiate between special theory of relativity and general theory of relativity.**

Ans: The **special theory of relativity** treats problems involving inertial or non-accelerating frames of reference.

The **general theory of relativity** treats problems involving frames of reference accelerating with respect to one another.

15. Write the relations of length contraction and time dilation in case of special theory of relativity.

Ans: Relation of length contraction is given as

$$\ell = \ell_0\sqrt{1-\frac{v^2}{c^2}}$$

Where ℓ_0 is proper length and ℓ is contracted length.

Relation of time dilation is given as

$$t = \frac{t_0}{\sqrt{1-\frac{v^2}{c^2}}}$$

Where t_0 is proper time and t is dilated time.

Topic IV: Black Body Radiation:

16. Photon A has twice the energy of photon B. What is the ratio of the momentum of A to that of B? **(5 Time)**

Ans: As the energy of photon A is twice the energy of photon B, so

$$E_a = 2E_b$$
$$P_a c = 2E_b$$
$$P_a = 2\frac{E_b}{c}$$
$$P_a = 2P_b$$

It means that if the energy of photon A is twice the energy of photon B then the momentum of photon A is twice the momentum of photon B.

17. As a solid is heated and begins to glow, why does it first appear red? **(11 times)**

Ans: Since the red light has longest wavelength, so it will be emitted first and solid appears red first.

18. What happens to the total radiations from a black body if its absolute temperature is doubled? **(10 times)**

Ans: Stefan-Boltzmann law is $E = \sigma T^4$

So by doubling temperature $E' = \sigma(2T)^4$

$$E' = 16\sigma T^4$$
$$E' = 16E$$

That is, total radiation energy will become sixteen times.

19. Which photon red, green or blue carries the most (a) energy (b) momentum? **(15 Times)**

Ans: Since

$$E = hf = \frac{hc}{\lambda}$$
$$E \propto \frac{1}{\lambda}$$

As

$$\lambda_{red} > \lambda_{green} > \lambda_{blue}$$

Hence blue light has most energy.

And since

$$p = \frac{h}{\lambda}$$
$$p \propto \frac{1}{\lambda}$$

As

$$\lambda_{red} > \lambda_{green} > \lambda_{blue}$$

Hence blue light has most momentum.

20. Which photon red or blue has greater energy?

Ans: Since

$$E = hf = \frac{hc}{\lambda}$$
$$E \propto \frac{1}{\lambda}$$

As

$$\lambda_{red} > \lambda_{blue}$$

Hence blue light photon has greater energy.

21. Which has the lower energy quanta, radio waves or X-rays? **(10 times)**

Ans: Since $E = hf = \frac{hc}{\lambda}$

$$E \propto \frac{1}{\lambda}$$

As $\lambda_{radio\ waves} > \lambda_{X-rays}$

So radio waves have lower energy quanta.

22. If the following particles have same energy which has the shortest wavelength alpha particle or neutron? **(2 times)**

Ans: α-particle will have the shortest wavelength.

As we know

$$\lambda = \frac{h}{mv}$$

Also, the energy of moving particle is,

$$K.E. = ½ mv^2$$

Or $K.E. = \frac{m^2v^2}{2m}$

Or $m^2v^2 = 2m\ (K.E.)$

Or $mv = \sqrt{2m\ (K.E.)}$

So, $\lambda = \frac{h}{\sqrt{2m\ (K.E.)}}$

As all given particles have same energy, therefore

$$\lambda \propto \frac{1}{\sqrt{m}}$$

As α-particle has greatest mass, therefore, it will have the shortest wavelength.

23. Why can red light be used in a photographic dark room when developing films, but a blue or white light cannot? **(2 times)**

Ans: As we know red light has longest wavelength in visible spectrum, therefore it has less energy than that of blue or white light. So red light is least scattered on account of its large wavelength. Hence, photographic films and the materials concerned are less affected in the presence of red light than high energy blue or white light.

24. When light shines on surface, is momentum transferred to metal surface? **(4 times)**

Ans: Yes, when light shines on surface, momentum is transferred to metal surface and also the energy. So metal is heated up.

$$E = hf$$

And $p = \frac{h}{\lambda}$

25. If an electron and proton have the same de-Broglie wavelength which particle has greater speed? Explain. **(5 times)**

Ans: From de-Broglie hypothesis

$$\lambda = \frac{h}{mv}$$

or $v = \frac{h}{m\lambda}$

Since wavelength is given same and h is Plank's constant. So,

$$v \propto \frac{1}{m}$$

Hence an electron being a lighter one will have greater speed.

26. We do not notice the de-Broglie wavelength for a pitched cricket ball. Explain why? **(3 times)**

Ans: According to de-Broglie hypothesis

$$\lambda = \frac{h}{mv}$$

As cricket ball has large mass, therefore wavelength "λ" of wave associated with it is so small that is not detectable.

27. Which has the lower energy quanta, radio waves or x-rays? Explain. (2 times)

Ans: Energy of quanta is given as

$$E = hf = \frac{hc}{\lambda}$$

Or $$E = \frac{\text{constant}}{\lambda}$$

Or $$E \propto \frac{1}{\lambda}$$

Radio waves has longer wavelength. Therefore, radio waves has lower energy quanta.

28. What are black body radiations and how can you get a black body? (4 times)

Ans: An object that absorbs all radiation falling on it, at all wavelengths is called a **black body.**

When a body is heated, it emits radiation. Its emission is called **black body radiation.**

Black body is a solid that has a hollow cavity within it and a small hole through which radiation can enter or escape. The inside is blackened with suit to make it as good an absorber and as bad a reflector as possible.

29. Define work function and threshold frequency.

Ans: The minimum amount of energy required to remove electrons from a metal surface is called **work function** of this metal.

The minimum frequency below which photoelectric effect cannot occur from a metal surface is called **threshold frequency** of this metal.

30. Is it possible to create a single electron from energy? Explain.

Ans: No, it is not possible to create a single electron from energy.

Creation of single electron will be against the law of conservation of charge and the law of conservation of momentum. In pair production an electron – positron pair is produced.

31. Why must the rest mass of photon be zero?

Ans: Light consists of small packets of energy called photon. Photon always moves

32. Find the energy of photon in radiowave of wavelength 100m.

Ans:

$\lambda = 100m$

$h = 6.63 \times 10^{-34} Js$

$c = 3 \times 10^{8} m/s$

$E = ?$

We know that

$$E = \frac{hc}{\lambda}$$

$$E = \frac{6.63 \times 10^{-34} \times 3 \times 10^{8}}{100}$$

$$E = 19.89 \times 10^{-28} J$$

Topic V: Interaction of Electromagnetic Radiation with Matter:

33. Why don't we observe a Compton Effect with visible light? (18 times)

Ans: The frequency of visible light is less than x-rays. And the wavelength of visible light is much greater than Compton wavelength of electron. So Compton effect cannot be observed with visible light.

34. Will higher frequency light eject greater number of electrons than low frequency light? (5 Times)

Ans: No, it will not. The number of ejected electrons depend upon the intensity of light. They are independent of frequency.

35. Define ionization potential and excitation potential. (4 times)

Ans: <u>**Ionization potential:**</u> The potential necessary to remove an electron from the atom is called ionization potential. It is expressed in volts.

<u>**Excitation potential:**</u> The potential required to raise orbital electron in atom from one energy level to another is called excitation potential.

36. Is it possible to create a single electron from energy? (6 times)

Ans: No, it is possible to create a single electron from energy. Because electron has

negative charge and photon has no charge. So the emittance of positron (anti-particle of electron) is necessary. Otherwise it will be the violation of law of conservation of charge.

37. **Will the bright light eject more electrons from a metal surface then dimmer light of the same colour?** **(6 times)**

Ans: Since $intensity \propto number\ of\ electrons$

And bright light is more intense than dimmer one. So bright light will eject more electrons than dimmer light.

18. **Photoelectric effect gives the evidence of the particle nature of light. Explain it how?**

Ans: Since $E = hf$

If light were simple a wave-like phenomenon, then increasing the intensity and thereby increasing the total energy falling on the surface would be expected to eventually provide enough energy to release electrons no matter what the frequency. Furthermore, in the classical picture one would expect the maximum energy of the emitted electrons to depend on the intensity of the light -- but it does not.

So this is evidence that light behaves as if it were a particle.

19. **Distinguish between photoelectric effect and Compton Effect.** **(2 times)**

Ans: The emission of electrons from a metal surface when exposed to suitable frequency light is called photoelectric effect.

And

When X-rays are scattered by loosely bound electrons from a graphite target, the phenomenon of change in wavelength is known as Compton effect.

0. **Define pair production and annihilation of matter.** **(2 times)**

Ans: <u>Pair production:</u> The change of very high energy photon into an electron, positron pair is called pair production.

<u>Annihilation of matter:</u> When a positron comes close to an electron, they annihilate and produce two photons in the gamma rays range. It is called annihilation of matter.

1. **A beam of red light and a beam of blue light having exactly the same energy. Which beam contains the greater number of photon?** **(3 times)**

Ans: Energy of photon is $E = hf = hC/\lambda$

Or $E_n = \frac{nhC}{\lambda}$ Or $n = E_n\lambda/hC$

As $E_n, h\ \&\ C\ are\ same\ so$ $n \propto \lambda$

Since $\lambda_{red} > \lambda_{blue}$ so red beam will have greater number of photons.

2. **What do you understand by work function and stopping potential?**

Ans: The minimum amount of energy required to remove an electron from the surface of a metal is called work function.

And the Stopping Potential is the potential difference applied to stop the electrons from being ejected from the surface when the light falls on it.

3. **What are the conclusions made from pair production?**

Ans: Pair production is the creation of an elementary particle and its antiparticle.

Pair production often refers specifically to a photon creating an electron-positron pair near a nucleus but can more generally refer to any particle-antiparticle pair creation.

Energy can be converted into mass according to $E = mc^2$

Define Compton Effect. Write formula of Compton shift for scattering angle θ **(3 times).**

Ans: When X-rays are scattered by loosely bound electrons from a graphite target, the phenomenon of change in wavelength is known as Compton Effect.

Compton shift for scattering angle θ is given as

$$\Delta\lambda = \frac{h}{m_o c}(1 - cos\theta)$$

Define Stopping potential and Threshold frequency.

Ans: <u>**Stopping potential:**</u> The Stopping Potential is the potential difference applied to stop the electrons from being ejected from the surface when the light falls on it.

Threshold frequency: The minimum value of frequency of incident light at which electrons are emitted from a surface is called threshold frequency.

46. Define Compton Effect.

Ans: The phenomenon of increase in wavelength of x-ray photon, scattered by loosely bound electrons from a graphite target is called Compton Effect.

47. Define Compton Effect and pair production.

Ans: When x-rays are scattered by loosely bound electrons from a graphite target, wavelength of the scattered x-rays is larger than the wavelength of the incident x-rays, it is known as **Compton Effect.**

$$\Delta\lambda = \frac{h}{m_0 c}(1-\cos\theta)$$

The change of very high energy $(\gamma - ray)$ photon into an electron, positron pair is called **pair production.**

48. Can pair production take place in vacuum? Explain. (5 times)

Ans: No, pair production cannot take place in vacuum.
In order to conserve the momentum and energy, the presence of heavy nucleus is essential. The vacuum has no particle or heavy nucleus. Therefore, pair production cannot take place in vacuum.

49. State and write formula for Compton's effect.

Ans: When x-rays are scattered by loosely bound electrons from a graphite target, wavelength of the scattered x-rays is larger than the wavelength of the incident x-rays, it is known as **Compton effect.**

$$\Delta\lambda = \frac{h}{m_0 c}(1-\cos\theta)$$

50. What is the condition of pair production? Briefly explain.

Ans: The change of very high energy (such as γ – ray) photon into an electron-position pair is called pair production.

In order to conserve energy & momentum, the presence of heavy nucleus is essential. with the speed of light and its mass is in the form of energy. Photons are never at rest.

51. Calculate the value of Compton wavelength of electron.

Ans: We know that

$$Compton\ Wavelength = \frac{h}{m_0 c}$$

Rest mass of electron $m_0 = 9.1\times10^{-31} Kg$

Putting values,

$$Compton\ wavelength = \frac{6.63\times10^{-34}}{9.1\times10^{-31}\times3\times10^{8}}$$
$$= 2.43\times10^{-12} m$$

52. Does brightness of beam of light primarily depends upon the frequency of photons or on the number of photons.

Ans: The brightness of beam of light primarily depends upon number of photons. It is the energy which depends upon frequency of photon.

53. Define Compton Effect. At what angle Compton shift becomes equal to the Compton wave length?

Ans: When X – rays are scattered by loosely bound electrons from a graphite target, wavelength of the scattered x – rays is larger than the wavelength of the incident x – rays, it is known as **Compton Effect.**

$$\Delta\lambda = \frac{h}{m_0 c}(1-\cos\theta)$$

Where $\Delta\lambda$ is Compton Shift and $\frac{h}{m_0 c}$ is Compton wavelength.

If $\theta = 90^0$ then

$$\Delta\lambda = \frac{h}{m_0 c}(1-\cos 90^0) = \frac{h}{m_0 c}(1-0) = \frac{h}{m_0 c}$$

Topic VI: Annihilation of matter:

54. What do you mean by annihilation of matter?

Ans: **Annihilation of matter:** When a positron comes close to an electron, they annihilate and produce two photons in the gamma rays range. It is called annihilation of matter.

Topic VII: Wave nature of particle:

55. What is wave particle duality? Give its one practical use.

Ans: It says that light has dual nature; it travels in the form of waves but interacts with matter in the form of energy particles called as photons.
e.g., In interference, refraction, reflection and polarization it shows the properties of wave nature but in phenomena like pair production and Compton's effect light acts as energy particles.

56. Write at least two justifications for light to behave as wave and as a particle.

Ans: Interference and diffraction confirms wave nature of light while photoelectric effect and Compton's effect confirms particle nature of light.

57. When does light behave as a wave? When does light behave as a particle? (2 times)

Ans: Light behave as a wave when it propagates from one place to other and light behave as a particle when it interacts with matter.
Light behaves as a wave in interference and diffraction.
Light behaves as a particle in photoelectric effect and Compton's effect.

Topic VIII: Uncertainty Principle:

58. State uncertainty principle. Give its two mathematical forms. OR Give two statements of uncertainty principle. (2 times)

Ans: The product of uncertainty in the measurement of momentum and uncertainty in the measurement of position of an electron is approximately equal to Planck's constant. $(\Delta p)(\Delta x) \approx h$
The product of uncertainty in the measurement of energy and uncertainty in the measurement of time of an electron is approximately equal to Planck's constant.

$$(\Delta E)(\Delta t) \approx h$$

59. What advantages an electron microscope has over an optical microscope? (7 Times)

Ans: (i) Resolving power of electron microscope is 1000 times greater than that of optical microscope.
(ii) Magnification of an electron microscope is also about 1000 times greater than that of optical microscope.
(iii) 3 – D image of remarkable quality can be obtained by electron microscope (SEM).

60. The life time of an electron in an excited state is 10^{-8} s. What is its uncertainty in energy during this time? (2 times)

Ans: From uncertainty principle

$$\Delta E . \Delta t \approx \hbar$$

Or

$$\Delta E = \frac{\hbar}{\Delta t} = \frac{1.05\times10^{-34}}{10^{-8}}$$

$$\Delta E = 1.05\times10^{-26} J$$

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61. Define pair production and write down its equation.

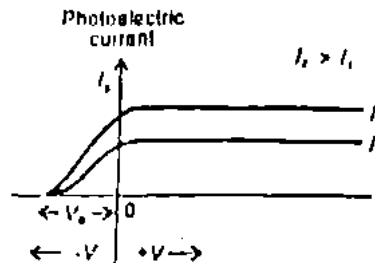
Ans: **Pair production:** The change of very high energy photon into an electron, positron pair is called pair production.
Equation:
Energy of incident photon $= 2m_oc^2 + (K.E)_{e^-} + (K.E)_{e^+}$

62. Write down the important results of photoelectric effect.

i. The electrons are emitted with different energies.
ii. The maximum energy of photoelectrons depends upon the surface of metal and the frequency of incident light.

III. There is a minimum frequency below which no photo emission takes place.
iv. Electrons are emitted instantaneously.
v. The number of emitted photoelectrons depends upon intensity of light.

63. Discuss the variation of photoelectric current with the intensity of light falling on plate of photocell.

Ans: The photo-electric current increases with intensity of light. The photoelectric current verses applied voltage for two intensities of monochromatic light is shown in figure. Where $I_2 > I_1$ it has been seen experimentally that the amount of current increases with light beam of higher intensity but the current stops for the same value of V_o.

64. Write the name of any four applications of photocell.

Ans: (1) Security systems
(2) Counting systems
(3) Automatic door systems
4) Automatic street lighting
5) Exposure meter for photography
6) Sound track of movies

65. What is the energy of photon in a beam of infra-red radiation of wavelength 1240 nm?

Ans: Given that

$$\lambda = 1240\ nm = 1240 \times 10^{-9}\ m$$
$$c = 3 \times 10^8\ ms^{-1}$$
$$h = 6.63 \times 10^{-34}\ Js$$
$$E = ?$$

Since

$$E = hf$$
$$E = \frac{hc}{\lambda}$$
$$E = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{1240 \times 10^{-9}}$$
$$E = 1.6 \times 10^{-19}\ J = 1\ \text{eV}$$

66. Define work function and threshold frequency.

Ans: The minimum amount of energy required to remove electrons from a metal surface is called **work function** of this metal.
The minimum frequency below which photoelectric effect cannot occur from a metal surface is called **threshold frequency** of this metal.

67. Define Stephen's Boltzmann Law. Also give the value of Stephen's constant.

Ans: Stephen's Boltzman Law This law states that area under each curve represents the total energy emitted over all wavelength at a particular temperature and is found to be directly proportional to the fourth power of absolute temperature of black body.

Mathematically $E \propto T^4$

$$E = \sigma T^4$$

Where σ constant called Stephen's constant and its value is is 5.67×10^{-8} watt m^2K^{-4}.

LONG QUESTIONS OF CHAPTER-19 IN ALL PUNJAB BOARDS 2011-2021

Topic III: Special Theory of Relativity:

1. Write down the postulate of special theory of relativity and also describe the four results of special theory of relativity. What is the NAVSTAR navigating system?
2. State the postulates of the special theory of relativity. Also write results of the special theory of relativity without going into their mathematical derivations. **(2 times)**

Topic IV: Black Body Radiation:

3. What is the black body radiation? Explain intensity distribution diagram.
4. Explain black body also gives the explanation of intensity distribution diagram with facts.

Topic V: Interaction of Electromagnetic Radiation with Matter:

5. Define photoelectric effect. Give its explanation on the basis of Quantum theory. **(9 Times)**
6. What is photoelectric effect? How its different results were successfully explained by Einstein?
7. Define Compton Effect. Find the expression for Compton shift. Draw its scattering diagram and label it.
8. Write a note on Compton Effect.
9. Define and explain Compton Effect.
10. Explain the photoelectric effect. What is the effect of frequency of light on photoelectric current and energy of photoelectrons? **(2 times)**
11. What is photoelectric affect? How its different results were successfully explained by Einstein?

Topic VII: Wave Nature of Particles:

12. State de Broglie hypothesis, give its formula. Also explain an electron microscope.
13. Explain de Broglie hypothesis. How Davisson and Germer experimentally verified the de Broglie hypothesis? **(8 times)**
14. Describe Davisson and Germer experiment to confirm the wave nature of electron. Also derive an expression for wave length.
15. What is the wave nature of particles? How Davisson and Germer experiment confirmed it.

Topic VIII: Uncertainty Principle:

16. What is Uncertainty Principle? Explain it.

NUMERICAL PROBLEMS OF CHAPTER-19 IN ALL PUNJAB BOARDS 2011-2021

Topic III: Special Theory of Relativity:

1. **Find the mass "m" of moving object with the speed of $0.8\,c$.** **(2 times)**

Ans: Given that

$$v = 0.8\,c$$
$$m = ?$$

Since

$$m = \frac{m_o}{\sqrt{1-\frac{v^2}{c^2}}}$$

$$m = \frac{m_o}{\sqrt{1-\frac{(0.8\,c)^2}{c^2}}}$$

$$m = \frac{m_o}{\sqrt{1-(0.8)^2}} \boxed{= 1.67\,m_o}$$

2. A bar 1.0 m in length and located along x-axis moves with the speed of 0.75 c with respect to a stationary observer. What is the length of the bar as measured by the stationary observer?

Ans: Given that

$$l_o = 1.0\ m$$
$$v = 0.75\ c$$
$$l = ?$$

Since

$$l = l_o\sqrt{1 - \frac{v^2}{c^2}}$$
$$l = 1.0 \times \sqrt{1 - \frac{(0.75\ c)^2}{c^2}}$$
$$l = 1.0 \times \sqrt{1 - (0.75)^2}$$
$$\boxed{l = 0.66\ m}$$

3. A particle of mass 5.0 mg moves with speed of 8.0 ms^{-1}. Calculate its de Broglie wavelength. **(6 times)**

Ans: Given that

$$m = 5.0\ mg = 5 \times 10^{-6}\ kg$$
$$v = 8.0\ ms^{-1}$$
$$h = 6.63 \times 10^{-34}\ Js$$
$$\lambda = ?$$

Since

$$\lambda = \frac{h}{mv}$$
$$\lambda = \frac{6.63 \times 10^{-34}}{5 \times 10^{-6} \times 8}$$
$$\boxed{\lambda = 1.66 \times 10^{-29}\ m}$$

4. What is the mass of a 70 kg man in a space rocket travelling at 0.8 c from us as measured from earth? **(6 times)**

Ans: Given that

$$m_o = 70\ kg$$
$$v = 0.8\ c$$
$$m = ?$$

Since

$$m = \frac{m_o}{\sqrt{1 - \frac{v^2}{c^2}}}$$
$$m = \frac{70}{\sqrt{1 - \frac{(0.8\ c)^2}{c^2}}}$$
$$m = \frac{70}{\sqrt{1 - (0.8)^2}} \boxed{= 116.7\ kg}$$

Topic IV: Black Body Radiation:

5. What is the energy of photon in a beam of infrared radiations having wavelength 1240 nm? **(3 Time)**

Ans: Given that

$$\lambda = 1240\ nm = 1240 \times 10^{-9}\ m$$
$$c = 3 \times 10^{8}\ ms^{-1}$$
$$h = 6.63 \times 10^{-34}\ Js$$
$$E = ?$$

Since $E = hf$

$$E = \frac{hc}{\lambda}$$

$$E = \frac{6.63 \times 10^{-34} \times 3 \times 10^{8}}{1240 \times 10^{-9}}$$

$$E = 1.6 \times 10^{-19} J$$

$$\boxed{E = 1.0\ eV}$$

6. **Assuming you radiate as does a black body at your body temperature about 37° C, at what wavelength do you emit the most energy?**

Sol: T = 37°C = (37 + 273) K = 310 K

Wien's Constant = 2.9×10^{-3} mk

$\lambda_{max} = ?$

As we know that

$\lambda_{max} \times T = \text{Constant}$

$$\lambda_{max} = \frac{\text{Constant}}{T}$$

$$\lambda_{max} = \frac{2.9 \times 10^{-3}}{310} = 9.35 \times 10^{-6} m$$

$\lambda_{max} = 9.35 \mu m$

7. **What is the maximum wavelength of the two photons produced when a position annihilats an electron? The rest mass energy of each is $0.51\ MeV$.**

Sol:

$E = 0.51 MeV$

$E = 0.51 \times 10^{6} ev$

$E = 0.51 \times 10^{6} \times 1.6 \times 10^{-19} J$

$E = 8.16 \times 10^{-14} J$

$c = 3 \times 10^{8} m/s$

$h = 6.63 \times 10^{-34} Js$

$\lambda = ?$

as $E = \frac{hc}{\lambda}$

or $\lambda = \frac{hc}{E}$

$$= \frac{6.63 \times 10^{-34} \times 3 \times 10^{8}}{8.16 \times 10^{-14}}$$

$\lambda = 2.437 \times 10^{-12} m$

or $\lambda = 2.44 \times 10^{-12} m$

Topic V: Interaction of Electromagnetic Radiation with Matter:

8. **X-rays of wavelength 22 pm are scattered from a carbon target. The scattered radiation being viewed at 85° to the incident beam. What is Compton shift?** **(2 times)**

Ans:

Given that

$$m_o = 9.1 \times 10^{-31} kg$$

$$c = 3 \times 10^{8} ms^{-1}$$

$$h = 6.63 \times 10^{-34} Js$$

$$\theta = 85^{o}$$

$$\Delta\lambda = ?$$

Since $\Delta\lambda = \frac{h}{m_o c}(1 - \cos\theta)$

$$\Delta\lambda = \frac{6.63 \times 10^{-34}}{9.1 \times 10^{-31} \times 3 \times 10^{8}}(1 - \cos 85^o)$$

$$\boxed{\Delta\lambda = 2.2 \times 10^{-12}\, m}$$

9. **A 50 KeV photon is Compton scattered by a quasi-free electron. If the scattered photon comes off at 45°, What is its wavelength?**

Sol: $E = 50\text{ KeV} = 50 \times 10^3\text{ eV}$

$= 50 \times 10^3 \times 1.6 \times 10^{-19}\text{ J} \qquad = 80 \times 10^{-19}\text{ J}$

$c = 3 \times 10^8$ m/s , $\theta = 45^0$, $h = 6.63 \times 10^{-34}$J.s

Scattered wavelength $\lambda = ?$

As $\quad E = hf = \frac{hc}{\lambda}$

Or $\quad \lambda = \frac{hc}{E} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{80 \times 10^{-16}}$

$$\lambda = 0.248 \times 10^{-10} m = 0.0248 nm$$

10. **A 90KeV x-ray photon is fired at a carbon target and Compton scattering occurs. Find wavelength of incident photon and the wavelength of scattered photon for scattering angle of 60^0.**

Sol: $E = 90\text{ KeV} = 90 \times 10^3 \times 1.6 \times 10^{-19}\text{ J}$

$E = 1.44 \times 10^{-14}$ J

$h = 6.63 \times 10^{-34}$ Js

$C = 3 \times 10^8$ m/s $\quad ; \quad \theta = 60^0$

$\lambda = ?$, $\quad \lambda' = ?$

As $\quad E = \frac{hc}{\lambda}$ $\quad$ or $\quad \lambda = \frac{hc}{E} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{1.44 \times 10^{-14}}$

$$\lambda = 13.81 \times 10^{-12} m = 13.81\ pm$$

We know that

$$\Delta\lambda = \lambda' - \lambda = \frac{h}{m_0 c}(1-\cos\theta)$$

Or $$\lambda' = \lambda + \frac{h}{m_0 c}(1-\cos\theta)$$

$$\lambda' = 13.81\times10^{-12} + \frac{6.63\times10^{-34}}{9.1\times10^{-31}\times3\times10^{8}}(1-\cos 60^0)$$

$$\lambda' = 15.02\times10^{-12}\,m = 15.02\ pm$$

Topic VII: Wave Nature of Particles:

11. What is the de-Broglie wavelength of an electron whose kinetic energy is $120\ eV$? (5 Times)

Ans: Given that

$$K.E. = 120\ eV = 120\times1.6\times10^{-19}\,J$$
$$mass\ of\ electron = m = 9.1\times10^{-31}\,kg$$
$$Planck's\ constant = h = 6.63\times10^{-34}\,Js$$
$$de-Broglie\ wavelength = \lambda = ?$$

Since
$$K.E. = \frac{1}{2}mv^2$$
$$v = \sqrt{\frac{2K.E.}{m}}$$
$$v = \sqrt{\frac{2(120\times1.6\times10^{-19})}{9.1\times10^{-31}}}$$
$$v = 6.65\times10^{6}\,ms^{-1}$$

Now
$$\lambda = \frac{h}{mv}$$
$$\lambda = \frac{6.63\times10^{-34}}{9.1\times10^{-31}\times6.65\times10^{6}} = \boxed{1.12\times10^{-10}\,m}$$

12. An electron is accelerated through a potential difference of $50\ V$. Calculate its de-Broglie wavelength. (8 Times)

Ans: Given that

$$mass\ of\ electron = m = 9.1\times10^{-31}\,kg$$
$$potential\ difference = V_o = 50\,V$$
$$charge\ on\ an\ electron = e = 1.6\times10^{-19}\,C$$
$$Planck's\ constnat = h = 6.63\times10^{-34}\,Js$$
$$de-Broglie\ wavelength = \lambda = ?$$

Since
$$\frac{1}{2}mv^2 = V_o e$$
$$\frac{1}{2m}m^2v^2 = V_o e$$
$$(mv)^2 = 2mV_o e$$
$$p^2 = 2mV_o e$$
$$p = \sqrt{2mV_o e}$$
$$p = \sqrt{2(9.1\times10^{-31})(50)(1.6\times10^{-19})}$$

Now
$$\lambda = \frac{h}{mv}$$
$$\lambda = \frac{h}{p}$$
$$\lambda = \frac{6.63\times10^{-34}}{\sqrt{2(9.1\times10^{-31})(50)(1.6\times10^{-19})}} = \boxed{1.74\times10^{-10}\,m}$$

Topic VIII: Uncertainty Principle:

13. An electron is placed in a box about the size of an atom that is about $1.0 \times 10^{-10}\ m$. What is the velocity of the electron? (8 times)

Ans: Given that

$$m = 9.1 \times 10^{-31}\ kg$$
$$h = 6.63 \times 10^{-34}\ Js$$
$$\Delta x = 1.0 \times 10^{-10}\ m$$
$$\Delta v = ?$$

Using uncertainty principle, $\Delta p \Delta x \approx h$

$$m\Delta v \Delta x \approx h$$
$$\Delta v = \frac{h}{m\Delta x}$$
$$\Delta v = \frac{6.63 \times 10^{-34}}{9.1 \times 10^{-31} \times 1.0 \times 10^{-10}}$$
$$\boxed{\Delta v = 7.29 \times 10^{6}\ ms^{-1}}$$

14. **An electron is to be confined to a box of the size of the nucleous $(1.0 \times 10^{-14} m)$. What would the speed of electron be if it were so confined?**

Sol: $\Delta x = 1.0 \times 10^{-14} m$

$m = 9.1 \times 10^{-31} kg$

$h = 6.63 \times 10^{-34} Js$

$\Delta v = ?$

According to uncertainty principle,

$\Delta x \Delta P \approx h$

or $\Delta x m \Delta v \approx h$

$$\Delta v = \frac{h}{m\Delta x}$$

Putting values,

$$\Delta v = \frac{6.63 \times 10^{-34}}{9.1 \times 10^{-31} \times 1.0 \times 10^{-14}}$$

$\Delta v = 7.29 \times 10^{10} m/s$

15. **The life time of an electron in an excited state is about $10^{-8} s$. What is its uncertainty in energy during this time?**

Sol: $\Delta t = 10^{-8} s$

$h = 6.63 \times 10^{-34} Js$

$\Delta E = ?$

According to uncertainty principle

$\Delta E \Delta t \approx h$

or $\Delta E \approx \frac{h}{\Delta t} \rightarrow (i)$

where $\hbar = \frac{h}{2\pi} = \frac{6.63 \times 10^{-34}}{2(3.14)} = 1.05 \times 10^{-34} Js$

putting values in eq. (i), we get

$$\Delta E = \frac{1.05 \times 10^{-34}}{10^{-8}}$$

$\Delta E = 1.05 \times 10^{-26} J$

OBJECTIVES (MCQ'S) OF CHAPTER-20 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Atomic Spectra:

1. The number of spectral lines in a complete spectrum of hydrogen atom is:
(A) 1 (B) 2 (C) 4 (D) Infinite

2. First spectral series of phydrogen atom was discovered by:
(A) Balmer (B) Lyman (C) Paschen (D) Redberg

3. Which of the following spectral series lies in the ultraviolet region: **(2 times)**
(A) Pfund series (B) Paschen series (C) Balmer series (D) Lyman series

4. The total number of spectral lines for an electron transitions from n = 5 to n = 1 states is:
(A) 1 (B) 5 (C) 7 (D) 10

5. The value of Rydberg Constant is: **(5 times)**
(A) $1.09\times10^{7}m^{-1}$ (B) $1.6\times10^{-19}C$ (C) $1.05\times10^{-34}J.S$ (D) $9.1\times10^{-31}Kg$

6. Balmer series is obtained when all electrons transitions terminate in:
(A) 1st orbit (B) 2nd orbit (C) 3rd orbit (D) 4th orbit

7. Atomic spectra are the examples of ______ spectra:
(A) Continuous (B) Line (C) Band (D) Mix

8. Balmer series lies in ______ region: **(9 times)**
(A) Visible (B) Invisible (C) Ultraviolet (D) Infrared

9. Paschen series is obtained when all the transitions of electron terminate on:
(A) 2nd orbit (B) 3rd orbit (C) 4th orbit (D) 5th orbit

10. The relation for paschen series is given as:
(A) $\frac{1}{\lambda} = R_H\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$ (B) $\frac{1}{\lambda} = R_H\left(\frac{1}{3^2} - \frac{1}{n^2}\right)$ (C) $\frac{1}{\lambda} = R_H\left(\frac{1}{4^2} - \frac{1}{n^2}\right)$ (D) $\frac{1}{\lambda} = R_H\left(\frac{1}{5^2} - \frac{1}{n^2}\right)$

11. The equation of Rydberg constant is given by:
(a) $R_H = \frac{ho}{m_o}$ (b) $R_H = \frac{Eo}{hc}$ (c) $R_H = \frac{Eo}{\lambda}$ (d) $R_H = \frac{1}{he}$

12. Nomally Electron can reside in excited state for about:
(A) 10^{-2}s (B) 10^{-8}s (C) 10^{-6}s (D) 10^{8}s

13. First spectral series of Hydrogen atom was discovered by
(A) Lyman (B) Rydberg (C) Balmer (D) Paschen

14. For Paschen series, the value of "n" starts from
(A) 2 (B) 4 (C) 6 (D) 8

15. Balmer empirical formula explains the electromagnetic radiation of any excited atom in terms of their.
(A) Energy (B) Mass (C) Wavelength (D) Momentum

Topic II: Bohr's Model of the Hydrogen Atom:

16. The total energy of electron in the state n = ∞ of the hydrogen atom is:
(A) Zero (B) 3.2 ev (C) 10.2 ev (D) 13.6 ev

17. The name electron was suggested by:
(A) Chadwick (B) Niel bohr (C) stoney (D) J.J Thomson

18. Bohr's second postulate $(mvr = n\frac{h}{2\pi})$ was justified by:
(A) Bohr himself (B) De=Broglie (C) Plan (D) Davission and Germer

19. On unified mass scale, 1 u equals:
(A) 12g (B) $1.66\times10^{-12}g$ (C) $1.66\times10^{-24}g$ (D) $1.66\times10^{-12}g$

20. The radius of 10th orbit in hydrogen atom is: **(2 times)**
(A) 0.053nm (B) 0.053m (C) 5.3nm (D) 53nm

21. The energy of electron in the 4th orbit of hydrogen atom is: (3 times)
(A) -2.51 ev (B) -3.50 ev (C) -13.6 ev (D) -0.85 ev

22. The orbital angular momentum in the allowed stationary orbits of hydrogen atom is given by: (2 times)
(A) $\frac{2\pi}{nh}$ (B) $\frac{nh}{2\pi}$ (C) $\frac{2h}{n\pi}$ (D) $\frac{h}{\pi}$

23. When an electron absorbs energy it jumps to:
(A) Lower energy state (B) Higher energy state
(C) Ground state (D) Remains in the same state

24. Speed of electron in first Bohr's orbit is:
(A) $2.19\times10^{6}ms^{-1}$ (B) $2.19\times10^{-6}ms^{-1}$ (C) $2.19\times10^{6}cms^{-1}$ (D) $2.19\times10^{-6}cms^{-1}$

25. Hydrogen atom spectrum does not lie in:
(A) Ultraviolet region (B) Visible region (C) Infra and region (D) X-ray region

26. The radius of first Bohr orbit in hydrogen atom is:
(A) 0.53 Cm (B) 0.53 nm (C) 0.053 nm (D) 0.0053 nm

27. If electrons jumps from second orbit to first orbit in hydrogen atom it emits photon of: (2 times)
(a) 3.40 eV (b) 10.20 eV (c) 13.6 eV (d) 3.8 eV

28. The speed of an electron in nth orbit is given as:
(a) $4\pi^2Ke^2/nh$ (b) $2\pi Ke^2/nh$ (c) $2\pi Ke/n^2h^2$ (d) $2\pi^2Ke^2/nh$

Topic III: Inner Shed Transition and Characteristics of X-Rays:

29. Which one of the following radiation is extremely penetrating:
(A) Y-rays (B) β -rays (C) a-rays (D) None of these

30. In an electronic transition, an atom cannot emit: (4 Times)
(A) $\gamma-rays$ (B) Infrared rays (C) UV-rays (D) X-rays

31. The potential required to remove an electron from the atom is called:
(A) Critical potential (B) Ionization potential (C) Absolute potential (D) Excitation potential

32. The numerical value of ground state energy for hydrogen atom in electron volt is:
(A) -10 (B) 13.6 (C) 10 (D) -13.6

33. If an electron jumps from nth orbit of energy E_n to pth (lower) orbit of energy Ep and a photon of frequency 'f' and wavelength 'λ' is thus emitted then:
(A) $f\lambda=E_n.E_p$ (B) $\frac{hc}{\lambda}=E_n-E_p$ (C) $hf=E_p.E_n$ (D) $h\lambda=E_p.E_n$

34. X-rays photon moves with a velocity of:
(A) Light (B) Less than velocity of light
(C) Greater than velocity of light (D) Sound

35. The charge on an Alpha particle is equal to:
(a) + e (b) - e (c) 2e (d) -2e

36. Photons emitted in inner shell transition are: (2 Times)
(a) Continuous X-rays (b) discontinuous X-rays (c) Characteristic X-rays (d) energetic X-rays

37. X – Rays are electromagnetic radiations having wavelength in the range:
(A) Proton (B) Electron (C) Baryon (D) Neutron

38. Radiations emitted by human body at normal temperature 37°C lies in:
(A) X-rays region (B) Infra red region (C) Visbile region (D) Ultraviolet region

Topic IV: Uncertainty with the Atom:

39. The following gas was identified in the sun using spectroscopy:
(A) Hydrogen (B) Helium (C) Carbon (D) Nitrogen

Topic V: Laser:

40. The population inversion is, in which:
(A) All electrons are in excited state (B) Some electrons are in excited state
(C) Majority of electrons are in excited state (D) Some electrons are in ground state

41. A finally focused beam of laser used to destroy:
(A) Cancerous cells (B) Pre-cancerous cells (C) Living cells (D) Both A and B

42. Helium-Neon laser discharge tube contains neon: (3 Times)
(A) 82% (B) 15% (C) 25% (D) 85%

43. For Holography we use
(A) X-rays (B) Laser (C) γ-rays (D) β - rays

44. The inverse phenomena to x-rays emission is: **(4 Times)**
(A) Diffraction (B) Polarization (C) Interference (D) Photoelectric effect

45. What is the more careful calculation by Warner Heisenberg:
(A) $\Delta E.\Delta t \approx h$ (B) $\Delta X.\Delta p \approx h$ (C) $\Delta X.\Delta p \geq h$ (D) $\Delta m.\Delta v \approx h$

46. In mass spectrograph mass of each ion reaching the detector is proportional to:
(A) $\sqrt{r}$ (B) B^2 (C) V^2 (D) $\sqrt{B}$

47. The uncertainty principle relates uncertainties in the measurements of energy and:
(A) Velocity (B) Momentum (C) Time (D) Mass of particle

48. Laser light has the property of:
(A) Coherent waves (B) Non-coherent waves (C) Sound waves (D) Water waves

49. Laser can only be produced if an atom is in its:
(A) Normal state (B) Excited state (C) Ionized state (D) De-excited state

50. According to uncertainty principle the quantitates which cannot be simultaneously measured with accuracy are:
(A) Energy ad momentum (B) Position and momentum
(C) Position and energy (D) Momentum and time

51. In Helium-Neon laser, the discharge tube is filled with: **(2 times)**
(A) 8% He, 20% Neon (B) 85% He, 15% Neon (C) 83% He, 17% Neon (D) 90% He, 10% Neon

52. Laser is beam of light which is:
(A) Monochromatic (B) Coherent (C) Unidirectional (D) All of these

53. Helium Neon laser beam emitted from a discharge tube has a colour:
(A) Blue (B) Green (C) Red (D) Black

54. Laser can be made by creating:
(A) Meta stable state (B) Population inversion (C) Excited state (D) All of these

55. Which is not characteristic of LASER?
(A) Monochromatic (B) Coherent (C) Intense (D) Multi directional

56. Life time of excited state (meta stable) is: **(2 Times)**
(A) 10^{-2} S (B) 10^{-3} S (C) 10^{-5} S (D) 10^{-8} S

2018

57. An electron in H atom is excited from ground state to n = 4. How many spectral lines are possible in this case? **(2 Times)**
(a) 6 (b) 5 (c) 4 (d) 3

58. The meta-stable state is .... than normal excited state. **(2 Times)**
(a) 10^{-5} times larger (b) 10^{-8} times smaller (c) 10^{5} times larger (d) 10^{-3} times larger

59. Radiation produced from T.V picture tube is:
(A) Gamma rays (B) X-rays (C) Infrared light (D) Ultra violet light

60. the Rest Mass of X-ray photon is: **(2 times)**
(A) 9.1×10^{-31} Kg (B) 1.67×10^{-27} Kg (C) 1.6×10^{-19} Kg (D) Zero

61. Paschen series lie in the:
(A) far ultraviolet region (B) visible region
(C) infrared region (D) ultraviolet region

62. The longest wavelength of Paschen series is:
(a) 656 nm (b) 1094 nm (c) 1875 (d) 2000 nm

63. The wavelength associated with the proton moving at a speed of 40 m/s is:
(a) 7.20 nm (b) 9.02 nm (c) 15.7 nm (d) 17.3 nm

64. Then energy of the photon of wavelength 500 nm is:
(a) 3.10 eV (b) 2.49 eV (b) 1.77 eV (d) 1.52 eV

65. X – rays are similar in nature to:
(a) $\gamma - rays$ (b) $\beta - rays$ (c) $\alpha - rays$ (d) Cathode rays

2019

66. The shortest wavelength in Lyman series is equal to:
(A) R_H (B) $\frac{R_H}{2}$ (C) $\frac{1}{R_H}$ (D) $\frac{2}{3}R_H$

67. If transition of electron in hydrogen atom ends at third orbit then radiation emitted lies in:
(A) Balmer (B) Lyman (C) Paschen (D) Bracket

68. In spectrum of hydrogen, bracket series lies in:
(A) Ultraviolet region (B) Visible region
(C) Infrared region (D) X-rays region

69. The diameter of an atom is of order of:
(A) 10^{-8} m (B) 10^{-10}m (C) 10^{-12}m (D) 10^{-14} m

70. X-rays eject electrons from matter by:
(A) Pair Production (B) Annihilation of Matter (C) Compton Effect (D) Photoelectric Effect

71. The relation for Balmer Series is written as:
(A) $\frac{1}{\lambda} = R_H\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$ (B) $\frac{1}{\lambda} = R_H\left(\frac{1}{3^2} - \frac{1}{n^2}\right)$
(C) $\frac{1}{\lambda} = R_H\left(\frac{1}{4^2} - \frac{1}{n^2}\right)$ (D) $\frac{1}{\lambda} = R_H\left(\frac{1}{5^2} - \frac{1}{n^2}\right)$

72. X-rays are the electromagnetic radiations having the wavelength in range:
(A) 10^{-12}m (B) 10^{-10}m (C) 10^{-8}m (D) 10^{-6}m

2021

73. X-rays has charge:
(A) Positive (B) Negative
(C) Zero (D) As that of α-particle

74. In Helium-Neon laser, the value of Helium is:
(A) 85% (B) 75% (C) 65% (D) 60%

75. The energy required to completely remove an electron from the first Bohr Orbit is called:
(A) Excitation (B) Ionization Energy
(C) Potential Energy (D) Kinetic Energy

76. The energy required to completely remove an electron from the first Bohr Orbit is called:
(A) Excitation Energy (B) Ionization Energy
(C) Potential Energy (D) Kinetic Energy

77. In the Bohr's model of hydrogen atom, the lowest orbit corresponds to:
(A) Infinite energy (B) Zero energy
(C) Minimum energy (D) Maximum energy

78. Finely focused beam of laser has been used to destroy
(A) Crystal structure (B) Cancerous cells (C) Weapons (D) Germs

79. Normally an electron can reside in metastable state for about:
(A) $10^{-8}s$ (B) $10^{-6}s$ (C) $10^{-4}s$ (D) $10^{-3}s$

80. Rydberg constant is given in unit of:
(A) kg^{-1} (B) m^{-1} (C) s^{-1} (D) Js

81. Which of the following is the energy required (in eV) for ionizing an excited Hydrogen atom:
(A) 13.6 eV (B) 10.2 eV
(C) More than 13.6 eV (D) 3.4 eV or less than it

ANSWERS OF THE MULTIPLE CHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
D	A	D	D	A	B	B	A	B	B	B	B	C	B	C	A	C
18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
B	C	C	D	B	B	A	D	C	B	B	A	A	B	D	B	A
35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
C	C	B	B	B	C	D	B	B	D	C	B	C	A	B	B	B
52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
D	C	D	D	B	A	D	B	D	C	C	B	B	A	C	C	C
69	70	71	72	73	74	75	76	77	78	79	80	81				
B	D	A	B	C	A	B	B	C	B	A	B	A				

SHORT QUESTIONS OF CHAPTER-20 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Atomic Spectra:

1. What do we mean when we say that the atom is excited? (22 times)

Ans: When energy from some external source is provided to an atom in its normal state, then its electrons will jump from lower energy state to higher energy states. And atom is said to be excited.

2. How can spectrum of hydrogen contain so many lines, whereas hydrogen atom contains one electron? (7 times)

Ans: The single electron in hydrogen atom occupies ground state but it can be excited to several states by absorbing energy. During de-excitation, it can emit several lines of different wavelengths.

3. Can the electron in the ground state of hydrogen atom absorb a photon of energy 13.6 eV and greater than 13.6 eV? (5 times)

Ans: Yes, an electron in the ground state of hydrogen atom can absorb a photon of energy 13.6 eV and greater than 13.6 eV.
Ionization energy of hydrogen atom in ground state is 13.6 eV. So if hydrogen absorbs a photon of energy greater than 13.6 eV then the surplus energy of photon appears as K.E of electron.

4. What is meant by line spectrum? How line spectrum can be used for the identification of elements? (6 times)

Ans: When an electron jumps from higher energy state to lower energy state then it emits energy and makes a spectral line.

$$E_2 - E_1 = hf$$

This is called line spectrum. And
Different elements emit line spectrum of different wavelengths. So they can be identified easily.

5. List of colours of line spectra of an excited hydrogen atom.

Ans: The colours of line spectrum of hydrogen atom are
i. Red ii. Blue iii. Blue-Green iv. Violet v. Ultraviolet

6. Differentiate between Line and Band spectrum.

Ans: <u>Line spectrum:</u> When electron jumps from higher orbit to lower orbit, it emits energy. This emission of energy constitutes spectral lines. This is called line spectrum.
<u>Band spectrum</u> is produced by molecules. They are the groups of lines which are closely spaced to one another.

7. In which region of electromagnetic spectrum does the following series fall (a) Lyman series (b) Balmer series?

Ans: Balmer series falls in the visible region.
Lyman series falls in the ultraviolet region.

8. Explain how line spectrum can be used for the identification of elements.

Ans: When a gas at much low pressure is excited by passing an electric current through it, the spectrum of emitted radiation is in the form of discrete sharp parallel lines. This type of spectrum is called line spectrum. In it each line corresponds to a definite wavelength and frequency. As each element has its own set of wavelengths in the line spectrum, so electrons of atoms in different element have different energy in their orbits and hence line spectrum can be used to identify the elements.

9. What is fluorescence?

Ans: Fluorescence is a property of absorbing radiant energy of high frequency and re emitting energy of low frequency in the visible region of electromagnetic spectrum.

10. Define continuous spectra and line spectra.

Ans: <u>Line spectrum:</u> When the atoms of a gas at much low pressure are excited by passing an electric current through it, the spectrum of emitted radiation is in the

form of discrete sharp parallel lines. This type of spectrum is called line spectrum.

Continuous spectrum: The radiations emitted by continuous media such as 'Black Body' forms a continuous spectrum. In continuous spectrum wavelengths of radiations cannot be observed in discrete lines.

11. Define spectroscopy.

Ans: The branch of physics that deal with the investigation of wavelengths and intensities of electromagnetic radiation emitted or absorbed by atoms is called spectroscopy.

Topic II: Bohr's Model of the Hydrogen Atom:

12. Bohr's theory of hydrogen atom is based upon several assumptions. Do any of these assumptions contradict classical physics? **(4 times)**

Ans: Bohr's first postulate contradicts classical physics. Bohr said that electron do not radiate energy during revolving while according to classical physics, electron radiates energy during revolving and fall into the nucleus, which is impossible.

13. Write two postulate of Bohr's model of H-atom. **(8 Time)**

Ans: i. An electron, bound to the nucleus in an atom, can move around the nucleus in certain circular orbits without radiating. These orbits are called the discrete stationary orbits.

ii. Only those stationary orbits are allowed for which orbital angular momentum is equal to an integral multiple of $\frac{h}{2\pi}$ i.e.

$$mvr = \frac{nh}{2\pi}$$

14. Find speed of electron in the 1st Bohr orbit. **(2 times)**

Ans: The speed of electron in the nth Bohr's orbit is given by:

$$v_n = \frac{2\pi Ke^2}{nh}$$

For 1st orbit n = 1 and

$$v_1 = \frac{2\pi Ke^2}{h}$$

$$v_1 = \frac{2(3.14)(9\times10^9)(1.6\times10^{-19})^2}{6.63\times10^{-34}}$$

$$v_1 = 2.19\times10^6 m/s$$

Topic III: Inner Shed Transition and Characteristics of X-Rays:

15. What do you mean by inner shell transition?

Ans: A transition in which an electron from higher orbit, emits energy and accommodates a hole in the lower orbit. Such a transition is called inner shell transition. The photons emitted in such transitions are called characteristic x-rays.

16. Write four uses of x-rays. **(3 times)**

Ans: X-rays are used

i. To visualize the interiors of the materials opaque to ordinary light

ii. In computerized axial tomography iii. In photographic films

17. Briefly describe continuous x-rays.

Ans: Continuous X-rays is due to an effect known as Bremsstrahlung effect when fast moving electrons bombarded at the target, they are suddenly slowed down on impact with the target. And due to deceleration their kinetic energy is converted into X-Ray photons.

18. How does a K_α X-rays differ from K_β X-rays? **(3 times)**

Ans: When an electron form $L - shell$ jumps to occupy the hole in $K - shell$, K_α X-rays is emitted.

And

When an electron form $M - shell$ jumps to occupy the hole in $K - shell$, K_β X-rays is emitted.

19. **Can x-ray be reflected, refracted, diffracted polarized just like any other waves? Explain.** **(6 Time)**

Ans: Yes, x-ray can be reflected, refracted, diffracted by crystals only and polarized just like any other waves.

20. **What is Spectroscopy? OR Define spectroscopy.**

Ans: It is that branch of physics which deals with the production, measurement and interaction of electromagnetic radiation emitted or absorbed by atoms is called spectroscopy.

21. **Define characteristic X-rays and continuous X-rays.**

Ans: <u>Characteristic X-rays:</u> The x-rays emitted from inner shell transitions are called characteristic x-rays and their energy depends on the type of target material.

<u>Continuous X-rays:</u> The x-rays emitted having continuous ranges of frequencies due to bremsstrauhlung effect are called continuous X-rays.

22. **Write two properties of x-rays.** **(2 times)**

Ans: Properties of x-rays

(i) They have a very short wavelength ($\approx 10^{-10}$m).

(ii) They cause ionization.

(iii) They affect photographic film in the same way as visible light.

(iv) They can penetrate several centimeters into a solid matter.

23. **How K_α and K_β x – rays are emitted?**

Ans: When fast moving electron strikes a target made of heavy element. Suppose, one of the electrons in the K – shell is removed, thereby producing a hole in that shell.

If electron from the L – shell jumps to occupy the hole in the K – shell then emitted radiations are called K_α x – rays.

(v) If electron from M – shell jumps to occupy the hole in the K – shell then emitted radiations are called K_β x – rays.

Topic IV: Uncertainty with the Atom:

24. **Give two forms of Uncertainty Principle.**

Ans: The product of uncertainty in the measurement of momentum and uncertainty in the measurement of position of an electron is approximately equal to Planck's constant.

$$(\Delta p)(\Delta x) \approx h$$

The product of uncertainty in the measurement of energy and uncertainty in the measurement of time of an electron is approximately equal to Planck's constant.

$$(\Delta E)(\Delta t) \approx h$$

25. **Can electron reside inside the nucleus? Explain.**

Ans: No, electron cannot reside inside the nucleus. If electron resides inside nucleus then uncertainty in position = size of nucleus = 10^{-14}m.

From Heisenberg uncertainty principle.

$$\Delta P \geq \frac{h}{\Delta x}$$

$$\geq \frac{6.63\times10^{-34}}{10^{-14}} = 6.63\times10^{-20}\, kgm/s$$

As $\Delta P = m\Delta v$

$$\Delta v = \frac{\Delta P}{m}$$

$$\Delta v = \frac{6.63\times10^{-20}}{9.1\times10^{-31}} \geq 7.3\times10^{10}\, m/s$$

This speed is impossible. Hence, electron cannot reside inside the nucleus.

Topic V: Laser:

26. **Is energy conserved when an atom emits a photon of light?** **(17 times)**

Ans: Yes, energy is conserved when an excited atom emits a photon of light. When atom is excited, energy is supplied. The same energy is emitted in the form of photon when it returns back to its ground state.

27. What are the advantages of Lasers over ordinary lights? **(15 Times)**

Ans: Laser light has many advantages over ordinary light such as laser light is

i. Coherent ii. Intense iii. Monochromatic iv. Unidirectional

28. Explain why laser action could not occur without population inversion between atomic levels? **(11 times)**

Ans: When a large percentage of atom or sample are in population inversion, then large number of coherent photons along same direction of motion could be obtained to form laser light. It is impossible without population inversion.

29. Give two uses of laser in medicine and industry. **(2 times)**

Ans: LASER is used

i. For welding detached retinas

ii. To destroy cancerous and pre-cancerous cells.

30. Define population inversion and meta stable state.

Ans: A condition of matter in which more electrons are in a high energy state than in a lower energy state is called population inversion.

And

A particular excited state of an atom that has longer lifetime ($\approx 10^{-3}s$) than the ordinary excited states ($\approx 10^{-8}s$) is called metastable state.

31. What are the differences between laser light and ordinary light? **(2 Times)**

Ans: The laser light is intense, unidirectional and phase coherent, so it does not spread as compared to ordinary light.

The energy of laser can be focused at a point to get enough heat for welding which is not possible with ordinary light.

A laser beam is used as a surgical tool for welding detached retina which ordinary light can't do.

Laser can induce fusion reaction which is impossible by common light.

32. Distinguish between stimulated emission and spontaneous emission. **(4 times)**

Ans: **Stimulated Emission:** If atom is excited for a longer life time of about 10^{-3} sec then an incident photon of energy equal to the difference of two energy levels induces the atom to decay by emitting a photon that travels in the direction of incident photon. This process is called stimulated or induced emission.

Spontaneous Emission: As excited is highly unstable state with life time of 10^{-8} sec, so electron will de-excite itself with emission of a photon in any arbitrary direction is called spontaneous emission.

33. Write down two uses of LASER in medicine. **(3 Times)**

Ans: For welding detached retinas.

To destroy cancerous and pre-cancerous cells.

34. Write down two uses of LASER in industry.

Ans: It can be used for telecommunication in fiber optics

It is used to read bar codes

It is used to generate 3D image of objects by holography.

35. Write down the two uses of LASER. **(2 times)**

Ans: LASER is used to destroy cancerous and pre-cancerous cells.

It is used to generate 3D image of objects by holography.

36. Define Ionization and Excitation Potential.

Ans: **Ionization Potential:** The potential (energy) required to completely remove an electron from the atom is called ionization potential. e.g., The ionization energy of Hydrogen atom in ground energy state is -13.6 eV.

Excitation Potential: The potential (energy) required to lift an electron from ground state to any higher allowed state is called excitation potential.

37. What is meant by Population Inversion and Lasing Action?

Ans: **Population Inversion:** A condition of atom in which more electrons are in a high energy state than in a lower energy state is called population inversion.

Lasing action: When a large percentage of atom or sample is in population inversion, then large number of coherent photons along same direction of motion could be obtained to form laser light. The combination of spontaneous emission first and then stimulated emission causes the laser to generate coherent beam of light at a single frequency which is called lasing action.

38. **What is meant by Population Inversion? Explain.**
Ans: **Population Inversion:** A condition of atom in which more electrons are in a high energy state than in a lower energy state is called population inversion.

39. **Define metastable state.**
Ans: **Metastable state:** A particular excited state of an atom that has longer lifetime ($\approx 10^{-3}s$) than the ordinary excited states ($\approx 10^{-8}s$) is called metastable state.

40. **What is meant by stimulated emissions?**
Ans: **Stimulated Emission:** If atom is excited for a longer life time of about 10^{-3}s then an incident photon of energy equal to the difference of two energy levels induces the atom to decay by emitting a photon that travels in the direction of incident photon. This process is called stimulated or induced emission.

41. **Define spectroscopy, holography.**
Ans: The branch of physics that deals with the investigation of wavelengths and intensities of electromagnetic radiation emitted or absorbed by atoms is called **spectroscopy**.
Laser beam is used to generate three – dimensional images of objects in a process called **holography**. **(3 Times)**

42. **What is a CAT scanner?**
Ans: A vastly improved x-ray technique is computerized axial tomography; the corresponding instrument is called CAT scanner.
In CAT scanning a "fanned-out" array of x-ray beams is directed through the patient from a number of different orientations. Computer is attached to construct picture. Density differences of the order of one percent can be detected.
Tumours, and other anomalies much too small to be seen with older techniques can be detected.

43. **Define normal population and population inversion.**
Ans: In **normal population**, the lower energy state has a greater population than the higher energy state.
Population inversion occurs when more electrons are in a higher energy state than in a lower energy state.

44. **How LASER is used in medical? Give two uses only.**
Ans: Two uses of LASER in medical are:
(i) For welding detached retinas.
(iii) To destroy cancerous and pre-cancerous cells.

45. **Write down four applications of laser.**
Ans: Laser is used:
(i) For welding detached retinas.
(ii) to destroy cancerous and pre-cancerous cells.
(iii) for telecommunication in fibre optics.
(i) to generate 3D image of objects by holography.

46. **Why does laser usually emit only one particular colour of light?**
Ans: Laser is produced by the transition of electrons from metastable state E_2 to lower energy state E_1. By this stimulated emission the energy of all the emitted photons is

$$hf = E_2 - E_1$$

Therefore, emitted light is of one particular wavelength or colour.

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47. **What is the biological effect of X-rays?**
Ans: X-rays cause damage to living tissue. As X-ray photons are absorbed in tissues, they break molecular bonds and create highly reactive free radicals (such as H and OH), which in turn can disturb the molecular structure of the proteins and especially the genetic material. Young and rapidly growing cells are particularly susceptible; hence X-rays are useful for selective destruction of cancer cells. On

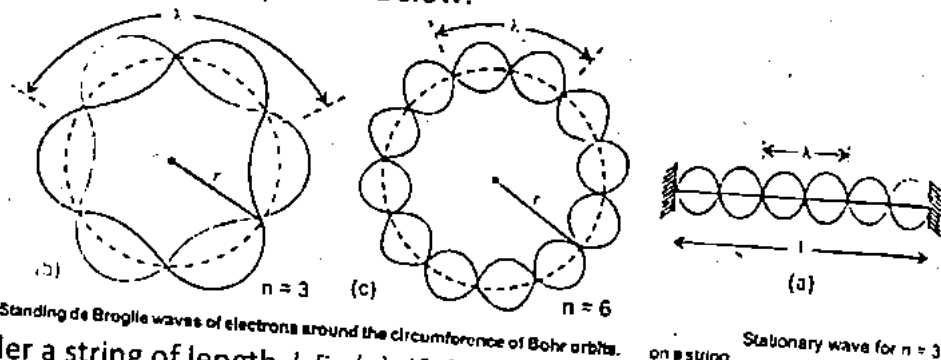
the other hand a cell may be damaged by radiation but survive, continue dividing and produce generation of defective cells. Thus X-rays can cause cancer. Even when the organism itself shows no apparent damage, excessive radiation exposure can cause changes in their productive system that will affect the organism's offspring.

48. What is Helium-Neon Laser?

Ans: It is a most common type of lasers used in physics laboratories. Its discharge tube is filled with 85% helium and 15% neon gas. The neon is the lasing or active medium in this tube. By chance, helium and neon have nearly identical metastable states, respectively located 20.61 eV and 20.66 eV level. The high voltage electric discharge excites the electrons in some of the helium atoms to the 20.61 eV state.

49. Explain de-Broglie's interpretation of Bohr's orbits.

Ans: At the time of formulation of Bohr's theory, there was no justification for the first two postulates, while Postulate *III* had some roots in Planck's theory. Later on with the development of de Broglie's hypothesis, some justification could be seen in Postulate II as explained below:

Standing de Broglie waves of electrons around the circumference of Bohr orbits. Stationary wave for n = 3 on a string.

Consider a string of length l fig (a). If this is put into stationary vibrations, we must have $l = n\lambda$ where n is an integer. Suppose that the string is bent into circle of radius r, as demonstrated for n = 3 and n = 6 in Fig. (b) and (c), so that

$$l = 2\pi r = n\lambda$$

Or

$$\lambda = \frac{2\pi r}{n}$$

From de Broglie's hypothesis

$$\lambda = \frac{h}{p} = \frac{h}{mv}$$

thus

$$\frac{h}{mv} = \frac{2\pi r}{n}$$

or $$mvr = \frac{nh}{2\pi}$$

which is Postulate II.

50. What are characteristic X-rays? How are they originated from the atoms?

Ans: In heavy atoms, the electrons are supposed to be arranged in concentric shells named as K, L, M, N, O. The K-shell being closed to the nucleus, next is L shell and so on. The inner shell electron are tightly bounded and large amount of energy is required to excite them. After excitation, when an atom returns to the ground state photons of larger energy are emitted. Thus, transition of inner shell electron in heavy atoms gives rise to the emittion of light energy or photons or X-rays. These X-rays consist of series of wavelengths or frequencies and hence are called characteristics X-rays. The study of characteristic X-rays spectra has played a very important role in the study of atomic structure and the periodic table of elements.

51. Define ionization energy and ionization potential.

Ans: The ionization energy also called ionization potential required to completely remove an electron from the atom is called ionization potential. e.g., The ionization energy of Hydrogen atom in ground energy state is -13.6 eV.

LONG QUESTIONS OF CHAPTER-20 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Atomic Spectra:

1. Derive the relations for the wave lengths of various series of spectral lines of hydrogen.
2. Calculate the longest Wavelength of Radiation for the Paschen Series.
3. Compute the shortest wavelength of radiation in Ballmer series. What value of n must be used?

Topic II: Bohr's Model of the Hydrogen Atom:

4. State the postulates of Bohr model of hydrogen atom and explain De-Broglie's interpretation of Bohr's orbit to show that $mvr = \frac{nh}{2\pi}$. **(3 Times)**
5. Write three postulates of Bohr atomic model. Derive expression for radii of quantized orbit of hydrogen atom. **(4Times)**
6. What are postulates of Bohr's model of the hydrogen atom? Show that radii of hydrogen atom are quantized? **(4 Times)**
7. According to Bohr's theory find the radii of different stationary orbits of an electron in hydrogen atom and also find Quantized Energies?
8. Write down the postulates of Bohr's atomic model. Show that Bohr radii and their energies are quantized. **(3 times)**
9. Write own the postulates of Bohr's atomic model. Show that Bohr radii and their energies are quantized.

Topic III: Inner Shed Transition and Characteristics of X-Rays:

10. What are X-rays? How are they produced? Give their two applications. **(2 times)**
11. What are the inner shell transitions and characteristics x-rays. Describe the production of x-rays.
12. Explain inner shell transitions and X-rays production. emission spectrum and also draw energy level diagram.
13. What do you mean by inner shell transitions? Also explain the production of x – rays.
14. What are the inner shell transitions and characteristics of x – rays? Describe the production of x – Rays.
15. Explain inner shell transitions and production of x – rays.
16. What do you mean by inner shell transitions? Also explain the production of x – rays.
17. What are inner shell transitions & characteristics of x –rays? Describe production of x – Rays. **(6 times)**
18. Explain inner shell transition and production of x – rays.

Topic V: Laser:

19. What is laser? Explain the terms population inversion and laser action.
20. Define spontaneous and stimulated emissions. Explain laser action in detail. **(2 times)**
21. What is LASER? Write down its properties. Explain how Helium-neon laser works?
22. What is Laser? Describe its working and action.
23. Define LASER and explain population inversion and laser action.

24. Explain the terms Metastable state, stimulated emission and population inversion which are necessary for LASER production.
25. Define LASER and explain population inversion and laser action.
26. Explain the terms Meta stable state, stimulated emission and population inversion which are necessary for LASER production.
27. What is laser? Describe principle and operation.

NUMERICAL PROBLEMS OF CHAPTER-20 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Atomic Spectra:

1. Calculate the longest wavelength of radiation for the Paschen series. **(9 Times)**

Ans:

For Paschen series $p = 3$

For longest wavelength $n = p + 1 = 3 + 1 = 4$

And $Rydberg\ constant = R_H = 1.0974 \times 10^7 m^{-1}$

Since $\frac{1}{\lambda} = R_H\left(\frac{1}{p^2} - \frac{1}{n^2}\right)$

$$\frac{1}{\lambda} = 1.0974 \times 10^7 \times \left(\frac{1}{(3)^2} - \frac{1}{(4)^2}\right)$$

$$\frac{1}{\lambda} = 1.0974 \times 10^7 \times \left(\frac{1}{9} - \frac{1}{16}\right)$$

$$\frac{1}{\lambda} = 1.0974 \times 10^7 \times \left(\frac{16-9}{144}\right)$$

$$\frac{1}{\lambda} = 1.0974 \times 10^7 \times \left(\frac{7}{144}\right)$$

$$\frac{1}{\lambda} = 5.33 \times 10^5$$

Thus $\lambda = \frac{1}{5.33\times10^5}$

$$\lambda = 1.875 \times 10^{-6}\ m$$

$$\lambda = 1875 \times 10^{-9}\ m$$

$$\boxed{\lambda = 1875\ nm}$$

2. Find the wavelength of spectral line corresponding to the transition in hydrogen from $n = 6$ state to $n = 3$ state.

Ans: As $n > p$,

So $n = 6$

$p = 3$

And

$Rydberg\ constant = R_H = 1.0974 \times 10^7 m^{-1}$

Since

$$\frac{1}{\lambda} = R_H\left(\frac{1}{p^2} - \frac{1}{n^2}\right)$$

$$\frac{1}{\lambda} = 1.0974 \times 10^7 \times \left(\frac{1}{(3)^2} - \frac{1}{(6)^2}\right)$$

$$\frac{1}{\lambda} = 1.0974 \times 10^7 \times \left(\frac{1}{9} - \frac{1}{36}\right)$$

$$\frac{1}{\lambda} = 1.0974 \times 10^7 \times \left(\frac{4-1}{36}\right)$$
$$\frac{1}{\lambda} = 1.0974 \times 10^7 \times \left(\frac{3}{36}\right)$$
$$\frac{1}{\lambda} = 1.0974 \times 10^7 \times \left(\frac{1}{12}\right)$$
$$\frac{1}{\lambda} = 9.145 \times 10^5$$

Thus

$$\lambda = \frac{1}{9.145 \times 10^5\ m}$$
$$\lambda = 1.094 \times 10^{-6}\ m$$
$$\lambda = 1094 \times 10^{-9}\ m$$
$$\boxed{\lambda = 1094\ nm}$$

3. What is the energy in eV of quanta of wavelength of 400 nm?

Ans:

Given that

$$\lambda = 400\ nm = 400 \times 10^{-9}\ m$$
$$c = 3 \times 10^8\ ms^{-1}$$
$$h = 6.63 \times 10^{-34}\ Js$$
$$E = ?$$

Since

$$E = hf$$
$$E = \frac{hc}{\lambda}$$
$$E = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{400 \times 10^{-9}}$$
$$E = 4.97 \times 10^{-19}\ J$$
$$E = \frac{4.97 \times 10^{-19}}{1.6 \times 10^{-19}}\ eV$$
$$\boxed{E = 3.10\ eV}$$

4. Compute the shortest and longest wavelength of radiation in Lyman Series.

Sol: For shortest wavelength in Lyman Series, electron jumps from $n=\infty$ to 1st orbit

i.e.

$n=\infty$, p = 1

We know that

$$\frac{1}{\lambda} = R_H\left(\frac{1}{p^2} - \frac{1}{n^2}\right)$$
$$\frac{1}{\lambda} = 1.0974\times10^7\left(\frac{1}{1^2} - \frac{1}{\infty^2}\right) = \frac{1.0974\times10^7}{1}$$
$$\lambda = \frac{1}{1.0974\times10^7} = 91.1\times10^{-9}\,m = 91.1nm$$

- For longest wavelength in Lyman series, electron jumps from 2nd orbit to 1st orbit

i.e. n = 2 & p = 1

Thus

$$\frac{1}{\lambda} = 1.0974\times10^7\left(\frac{1}{1^2} - \frac{1}{2^2}\right) = \frac{1.0974\times10^7\times3}{4}$$

$$\lambda = \frac{4}{1.0974 \times 10^7 \times 3} = 1.214 \times 10^{-7} m = 121.4 \times 10^{-9} m = 121.4\ nm$$

5. An electron jumps from a level $E_1 = -3.5 \times 10^{-19}$ J to $E_2 = -1.20 \times 10^{-18}$ J. What is the wavelength of the emitted light?

Ans:

Given that

$$E_i = -3.5 \times 10^{-19}$$
$$E_f = -1.20 \times 10^{-18}$$
$$h = 6.63 \times 10^{-34}\ Js$$
$$c = 3 \times 10^8\ ms^{-1}$$
$$\lambda = ?$$

We know

$$hf = E_f - E_i$$

Or

$$\frac{hc}{\lambda} = E_f - E_i$$
$$\lambda = \frac{hc}{E_f - E_i}$$

Putting the values,

$$\lambda = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{-1.20 \times 10^{-18} - (-3.5 \times 10^{-19})}$$
$$\lambda = \frac{19.89 \times 10^{-26}}{-1.20 \times 10^{-18} + 3.5 \times 10^{-19}}$$
$$\lambda = \frac{19.89 \times 10^{-26}}{0.85 \times 10^{-18}}$$
$$\lambda = 23.4 \times 10^{-8}\ m = 234 \times 10^{-9}\ m \boxed{= 234\ nm}$$

6. Compute the shortest wavelength radiation in Balmer. What value of n must be used? **(6 times)**

Ans:

For Balmer series $p = 2$

For shortest wavelength $n = \infty$

and Rydberg constant $= R_H = 1.0974 \times 10^7 m^{-1}$

Since

$$\frac{1}{\lambda} = R_H\left(\frac{1}{p^2} - \frac{1}{n^2}\right)$$
$$\frac{1}{\lambda} = 1.0974 \times 10^7 \times \left(\frac{1}{(2)^2} - \frac{1}{(\infty)^2}\right)$$
$$\frac{1}{\lambda} = 1.0974 \times 10^7 \times \left(\frac{1}{4} - 0\right)$$
$$\frac{1}{\lambda} = 0.27435 \times 10^7$$

Thus

$$\lambda = \frac{1}{0.27435 \times 10^7}$$
$$\lambda = 3.6449 \times 10^{-7}\ m$$
$$\lambda = 364.5 \times 10^{-9}\ m \boxed{= 364.5\ nm}$$

Topic II: Bohr's Model of the Hydrogen Atom:

7. Find the speed of electron in the First Bohr Orbit. **(6 times)**

Ans: Given that

$$n = 1$$
$$v = ?$$

We know,

$$v_n = \frac{2\pi ke^2}{nh}$$

As for first orbit n=1, so

$$v_1 = \frac{2\pi ke^2}{h}$$

Here,

$$k = 9 \times 10^9\ Nm^2C^{-2}$$
$$e = 1.6 \times 10^{-19}\ C$$
$$h = 6.63 \times 10^{-34}\ Js$$

Putting the values,

$$v_1 = \frac{2 \times 3.14 \times 9 \times 10^9 \times (1.6 \times 10^{-19})^2}{6.63 \times 10^{-34}}$$
$$v_1 = \frac{2 \times 3.14 \times 9 \times 10^9 \times 2.56 \times 10^{-38}}{6.63 \times 10^{-34}}$$
$$v_1 = \frac{144.69 \times 10^{-29}}{6.63 \times 10^{-34}} \boxed{= 2.18 \times 10^6\ ms^{-1}}$$

Topic III: Inner Shed Transition and Characteristics of X-Rays:

8. **Electron in x-ray tube is accelerated through a potential difference of $3000\ V$. If these electrons were slowed down in a target. What will be the minimum wavelength of the x-rays produced? (3 times)**

Ans: Given that

$$V = 3000\ V$$
$$\lambda_{min} = ?$$

Since

$$(K.E.)_{max} = hf_{max}$$
$$Ve = hf_{max}$$

For maximum frequency, wavelength will be minimum, so

$$\frac{hc}{\lambda_{min}} = Ve$$
$$\lambda_{min} = \frac{hc}{Ve}$$
$$\lambda_{min} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{3000 \times 1.6 \times 10^{-19}} \boxed{= 4.14 \times 10^{-10}\ m}$$

9. **A tungsten target is struck by electrons that have been accelerated from rest through 40 kV potential differences. Find the shortest wavelength of the bremsstrahlung. (3 times)**

Sol: $V = 40KV = 40\times10^3$ Volts

$\lambda = ?$

$h = 6.63\times10^{-34}\ Js \quad C = 3\times10^8 ms^{-1}$

$e = 1.6\times10^{-19} C$

As

$$\frac{hc}{\lambda} = Ve$$

Or $$\lambda = \frac{hc}{Ve}$$

$$\lambda = \frac{6.63\times10^{-34}\times3\times10^{8}}{40\times10^{3}\times1.6\times10^{-19}}$$

$$\lambda = \frac{19.89\times10^{-26}}{64\times10^{-16}}$$

$$\lambda = 0.31\times10^{-10}m$$

10. The wavelength of $K X-ray$ from copper is $1.377\times10^{-10}m$, what is the energy difference between the two levels from which this transition results? (3 times)

Sol: $\lambda = 1.377\times10^{-10}m$

$h = 6.63\times10^{-34}Js$

$c = 3\times10^{8}m/s$

$\Delta E = ?$

We know that

$$\Delta E = \frac{hc}{\lambda}$$

$$\Delta E = \frac{6.63\times10^{-34}\times3\times10^{8}}{1.377\times10^{-10}}$$

$$\Delta E = 14.44\times10^{-16}J$$

$$\Delta E = \frac{14.44\times10^{-16}}{1.6\times10^{-19}}eV$$

$$(\because 1eV = 1.6\times10^{-19}J)$$

$$\Delta E = 9.025\times10^{3}eV$$

$$\therefore \Delta E = 9.025KeV$$

Or $$\Delta E = 9.03KeV$$

11. What is the energy in eV of quanta of wavelength of $\lambda = 500nm$?

Sol: $\lambda = 500nm$

$\lambda = 500\times10^{-9}m$

$h = 6.63\times10^{-34}Js$

$c = 3\times10^{8}m/s$

$E = ?$

As $$E = \frac{hc}{\lambda}$$

Putting values,

$$E = \frac{6.63\times10^{-34}\times3\times10^{8}}{500\times10^{-9}}$$

$E = 3.98 \times 10^{-19}\ J$

$$E = \frac{3.98\times10^{-19}}{1.6\times10^{-19}} eV$$

$E = 2.49 eV$

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12. What are the energies in eV of quanta of wavelength? $\lambda = 400, 500$ and 700 nm.

Given that

Wavelength $\lambda_1 = 400\,nm = 400\times10^{-9}\,m$

Wavelength $\lambda_2 = 500\,nm = 500\times10^{-9}\,m$

Wavelength $\lambda_3 = 700\,nm = 700\times10^{-9}\,m$

Energy in eV of quanta $= E_1 = ?$

Energy in eV of quanta $= E_2 = ?$

Energy in eV of quanta $= E_3 = ?$

Solution

By formula

$$E = \frac{hc}{\lambda}$$

For 1st wavelength λ_1

$$E_1 = \frac{hc}{\lambda_1}$$

$$= \frac{6.63\times10^{-34}\times3\times10^{8}}{400\times10^{-9}} = 0.049\times10^{-34+8+9}$$

$$= 0.049\times10^{-17} = 4.9\times10^{-19} J$$

$$= \frac{4.9\times10^{-19}}{1.6\times10^{19}} eV$$

$$E_1 = 3.06\ eV$$

For 2nd wavelength λ_2

$$E_2 = \frac{hc}{\lambda_2}$$

$$= \frac{6.63\times10^{-34}\times3\times10^{8}}{500\times10^{-9}} = 0.0397\times10^{-17} J$$

$$= \frac{0.0397\times10^{-17}}{1.6\times10^{-19}} eV$$

$$E_2 = 0.0248\times10^{2} \quad = 2.48 eV$$

For third wavelength λ_3.

$$E_3 = \frac{hc}{\lambda_3}$$

$$= \frac{6.63\times10^{-34}\times3\times10^{8}}{700\times10^{-9}}$$

$$= 0.0284\times10^{-17}$$

$$= 0.0284\times10^{-17} = 2.84\times10^{-19} J = \frac{2.84\times10^{-19}}{1.6\times10^{-19}} eV = 1.75\ eV$$

13. The orbital electron of a hydrogen atom moves with a speed of $5.456\times10^{5} ms^{-1}$:

(a) Find the value of the quantum number "n" associated with this electron

(b) Calculate the radius of this orbit, and

(c) The energy of the electron In this orbit.

Data

Speed of electron $= V_n = 5.456\times10^{5}\ m/s$

To Find

(a) Value of quantum number = n = 7

(b) Radius of this orbit $= r_n = ?$

(C) Energy of electron in this orbit $= E_n = ?$

Solution:

(a) By formula

$$V_n = \frac{2\pi Ke^2}{nh}$$

$$n = \frac{2\pi Ke^2}{V_n h}$$

As $K = 9\times10^{9}\ Nm^2/c^2$

$$c = 1.6\times10^{-19} c$$

$$h = 6.63\times10^{-34} J.S$$

$$n = \frac{2(3.14)\times9\times10^{9}\times(1.6\times10^{-19})^2}{5.456\times10^{5}\times6.63\times10^{-34}}$$

$$= \frac{144.69\times10^{9-38}}{36.17\times10^{5-34}}$$

$$= \frac{144.69\times10^{-29}}{36.17\times10^{-29}}$$

$$n = 4.00$$

So the value of quantum number = n= 4

(b) For radius of 4th orbit

$$r_n = 0.053 n^2 nm$$

$$r_4 = 0.053\times(4)^2\ nm$$

$$r_4 = 0.848\ nm$$

$$= 0.85\ nm$$

Radius of this orbit $= r_4 = 0.85 nm$

(c) For the energy of electron in 4th orbit

$$= E_n = \frac{E_n}{n^2}$$

But $E_o = 13.6 eV$

and $n = 4$

$$E_4 = \frac{13.6}{4^2} eV$$

$$E_4 = -0.85 eV$$

OBJECTIVES (MCQ'S) OF CHAPTER-21 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Atomic Nucleolus:

1. Electron is an antiparticle of:
(A) Proton (B) Photon (C) Positron (D) Deuteron
2. Which of the following are elementary particle:
(A) Protons (B) Neutrons (C) Photons (D) Mesons
3. Subatomic Particles are divided into groups:
(A) Photon (B) Leptons (C) Hadrons (D) All these
4. Mass of proton is:
(A) 1.67×10^{-27} kg (B) 1.6×10^{-19} kg (C) 1.67×10^{-31} kg (D) 9.1×10^{-31} kg
5. The charge on the β particle is:
(A) +e (B) +2e (C) −e (D) None of these **(3 times)**
6. The number of neutrons in the nucleus is:
(A) N = A − Z (B) N = A + Z (C) $N = \frac{A+Z}{2}$ (D) $N = \frac{A-Z}{2}$

Topic II: Isotopes:

7. Both Xenon and Cesium each has isotopes:
(A) 12 (B) 33 (C) 36 (D) 39
8. Number of isotopes of Helium is:
(A) 2 (B) 3 (C) 4 (D) 5
9. The quantity of U_{92}^{235} in the naturally occurring uranium is:
(A) 0.2% (B) 0.3% (C) 0.7% (D) 4%
10. The number of neutrons in $^{7}_{3}Li$ is:
(A) 3 (B) 7 (C) 4 (D) 2
11. Relation for half life of any radioactive element is:
(A) $T_{1/2} = \lambda\ (0.693)$ (B) $\lambda = T_{1/2}\ (0.693)$ (C) $T_{1/2} = \frac{0.693}{\lambda}$ (D) $T_{1/2} = \frac{\lambda}{0.693}$
12. Half-life of a radioactive element $T_{1/2}$ is given by:
(a) 0.693λ (b) $\frac{0.693}{\lambda}$ (c) $\frac{\lambda}{0.693}$ (d) $\frac{1}{0.693\lambda}$ **(2 times)**
13. Half life of U-238 is:
(a) 2.5×10^{9} years (b) 3.5×10^{9} years (c) 4.5×10^{9} years (d) 5.5×10^{9} years
14. The number of isotopes of xenon are:
(A) 32 (B) 36 (C) 38 (D) 33

Topic III: Mass Defect and Binding Energy:

15. When a β particle is emitted, out of any nucleus, then its mass number:
(A) Increased (B) No changes (C) Decrease (D) Infinity **(32 times)**
16. 1 U (unified mass scale) is equal to:
(A) 880 Mev (B) 931 Mev (C) 931 ev (D) 931 Kev
17. One joule of energy absorbed in a body per kilogram is equal to:
(A) One rad (B) One rem (C) One gray (D) One sievert **(2 Times)**
18. The mass of beta particle is equal to mass of:
(A) Proton (B) Electron (C) Neutron (D) Boron **(2 times)**
19. When γ -rays are emitted, the nuclear mass:
(A) Decreases by 4 units (B) Does not change
(C) Increases by 2 units (D) Increases by 1 units
20. 1 a.m.u is equal to:
(A) 1.66×10^{-19} kg (B) 1.66×10^{-24} kg (C) 1.66×10^{-27} kg (D) 1.66×10^{-34} kg

Topic IV: Radioactivity:

21. Neutron was discovered by:
(A) Rutherford (B) Chadwick (C) Becquerel (D) Curie

22. Which of the following is similar to electron: **(2 times)**
(A) α-particle (B) β -particle (C) Neutrino (D) Photon

23. The rate of decay of a radioactive substance:
(A) Remains constant with time (B) Increase with time
(C) Decrease with time (D) May increase or decrease with time

24. Colour television (while operating) emits:
(A) $\alpha-rays$ (B) $\beta - rays$ (C) $\gamma-rays$ (D) X-rays

25. Which is the equation of beta decay:
(A) ${}^{A}_{Z}X \rightarrow {}_{Z+1}{}^{A}Y + {}^{0}_{-1}e$ (B) ${}^{A}_{Z}X \rightarrow {}^{A-1}_{Z}Y + {}^{0}_{-1}e$ (C) ${}^{A}_{Z}X \rightarrow {}^{A+1}_{Z+1}Y + {}^{0}_{-1}e$ (D) ${}^{A}_{Z}X \rightarrow {}^{A-1}_{Z-1}Y + {}^{0}_{-1}e$

26. By emitting β particle and γ particle simultaneously the nucleus changes its charge by:
(A) Losses by 1 (B) Increases by 1
(C) Increases by 2 (D) No change will be observed

27. Radioactivity happens due to disintegration of:
(A) Nucleus (B) Mass (C) Electrons (D) Protons

28. An α particle contains:
(A) "1" proton and "1" neutron (B) "2" proton and "2" neutron
(C) "3" proton and "3" neutron (D) "4" proton and "4" neutron

29. Which one is more energetic:
(A) γ -rays (B) X-rays (C) Ultra violet rays (D) Visible light

30. By emitting βparticle and γparticle simultaneously, the nucleus changes its charge by: **(2 times)**
(A) Losses by 1 (B) Increases by 1
(C) increases by 2 (D) No change will be observed

31. γ rays emitted from radioactive elements have speed: **(3 times)**
(A) $1\times10^{7}ms^{-1}$ (B) $1\times10^{8}ms^{-1}$ (C) $3\times10^{8}ms^{-1}$ (D) $4\times10^{9}ms^{-1}$

32. Which of the following has no charge:
(A) Alpha rays (B) Beta rays (C) Gamma rays (D) Cathode rays

33. The units of decay constant is: **(3 times)**
(A) Second (B) (Second)$^{-1}$ (C) m^{-1} (D) mk

34. Speed of β particles is nearly equal to:
(A) 1 x 10^{8} m/s (B) 10^{7} m/s (C) 3 x 10^{8} m/s (D) 10^{6} m/s

35. The number of Neutrons in ${}^{238}_{92}U$is:
(a) 92 (b) 238 (c) 146 (d) 330

36. Which particle has larger range in air?
(a) $\alpha - particle$ (b) $\gamma - particle$ (c) $\beta - particle$ (d) Neutron

37. α – particles carry a charge:
(a) –e (b) +2e (c) -2e (d) no charge

38. Engegy released by conversion of 1 amu is
(A) 1-6 x 10^{-19} ev (B) 1-6 x 1-6 x 10^{-19}Mev (C) 200 Mev (D) 931 Mev

39. How many times, the α – Particle is more massive than electron?
(A) 6332 (B)7332 (C) 8332 (D)9332

40. When a nucleus emits alpha particle, its atomic mas decreases by: **(2 times)**
(A) 3 (B) 2 (C) 4 (D) 1

41. One joule of energy absorbed in a body per kg is equal to:
(A) 1 rad (B) 1 rem (C) 1 Sievert (D) 1 gray

42. The amount of energy required to break the nucleus is called its:
(A) Nuclear energy (B) Kinetic energy (C) Potential energy (D) Binding energy
43. The decy constant of a radioactive element depends upon:
(A) Nature of material (B) Temperature of material (C) Pressure on material (D) all of these
44. Marie curie and pierre curie discovered:
(A) Uranium (B) Uranium and radium (C) Polonium and radium (D) Radium

Topic V: Half Life:

45. Half-life of radium -226 is: (3 times)
(A) 1820 years (B) 1940 years (C) 1620 years (D) 1680 years
46. Half life of the iodine -131 is 8 days and its weight 20 mg. After 4 half-lives, the amount left undecayed will be: (2 times)
(A) 2.5 mg (B) 1.25 mg (C) 0.625 mg (D) 0.3112 mg
47. Cancer of the Thyroid gland is curved by: (5 Times)
(A) Carbon-14 (B) Sodium-24 (C) Iodine-131 (D) Cesuium-137
48. A sample contains N radioactive nuclei. After 4 half-lives number of nuclei decayed is:
(A) $\frac{4}{16}$ (B) $\frac{15N}{16}$ (C) $\frac{N}{8}$ (D) $\frac{7N}{8}$
49. After two half – lives, the number of decayed nuclei of an element are:
(A) N (B) $\frac{N}{2}$ (C) $\frac{N}{4}$ (D) $\frac{3N}{4}$
50. The element formed by radioactive dacay is called:
(A) Father element (B) Mother element (C) Parent element (D) Daughter element

Topic VI: Interaction of Radiation with matter:

51. For holography we use a beam of:
(A) γ -rays (B) X-rays (C) β -rays (D) Laser
52. When a nucleus emits α particle, its mass number drops by: (4 Times)
(A) 1 (B) 2 (C) 4 (D) 6
53. Dr. Abdus Salam unified electromagnetic force and:
(A) Weal nuclear force (B) Strong nuclear force (C) Magnetic force (D) Gravitational force
54. The ionizing power of β particle is:
(A) Equal to α particle (B) Equal to γ particle
(C) Greater then α particle (D) Less than α particle
55. When Nitrogen is Bombarded Alpha Particle, then Nitrogen Nuclie change into ----- Nuclie:
(A) Oxygen (B) Carbon (C) Heluim (D) Beryllium

Topic VII: Radiation Detectors:

56. A devise which shows the visible path of ionizing particle is called: (3 times)
(A) G.M counter (B) Solid detector (C) Scalar (D) Wilson-cloud Chamber
57. In Nuclear reactor, Uranium is enriched upto:
(A) (1-2)% (B) (1-3)% (C) (2-3)% (D) (2-4)%
58. In a fast (nuclear) reactor $^{238}_{92}U$ nucleus absorbs a fast neutron and is ultimately transformed into ______ by emitting two β particles:
(A) $^{235}_{92}U$ (B) $^{239}_{94}Pu$ (C) $^{208}_{82}Pb$ (D) $^{232}_{90}Th$
59. Geiger counter can be used to detect:
(A) Charge (B) Mass (C) $\frac{charge}{mass}$ ratio (D) Nuclear radiation
60. β particles in Wilson cloud chamber gave:
(A) Zigzag or erratic path (B) Curved path (C) Circular path (D) Elliptical path
61. A high potential difference of______ is used in G.M counter:
(A) 400 volts (B) 1000 volts (C) 5000 volts (D) 4000 volts

62. The total amount of energy radiated per unit orific area of cavity radiator per unit time proportional to:
(A) T (B) T^2 (C) T^3 (D) T^4

63. A detector can count fast and operate low voltage is:
(A) G.M counter (B) Solid state detector
(C) Wilson cloud chamber (D) Bubble chamber

64. To shut down the nuclear reactor _____ are inserted into the reactor:
(A) Uranium rod (B) Cadmium rod (C) Plutonium rod (D) Iron rod

65. The dead time of Geiger Muller counter is of the order of: (5 times)
(A) $10^{-1}s$ (B) $10^{-2}s$ (C) $10^{-3}s$ (D) $10^{-4}s$

66. The average of the background radiation to which we are exposed per year: (2 times)
(A) 2 mSv (B) 1 mSv (C) 3 mSv (D) 0.01 Sv

67. Dead time of G.M Counter is: (2 times)
(A) 10^{-5} Sec (B) 10^{-4} Sec (C) 10^{-3} Sec (D) 10^{-2} Sec

68. A device that shows the visible path of ionizing particle is called
(A) GM Counter (B) Solid state detector (C) Scalar (D) Wilson Cloud Chamber

69. Gm-counter uses
(A) Alcohol only (B) Bromine (C) Argon (D) Neon and bromine

Topic VIII: Nuclear Reactions:

70. The maximum safe limit weekly dose for persons working in a nuclear reactor is:
(A) 1 mSv (B) 2 mSv (C) 3 mSv (D) 5 mSv

71. Which nuclear reaction takes place in the sun and stars:
(A) Fission (B) Chemical (C) Fusion (D) Mechanical

72. When Nitrogen is bombarded by Alpha Particles, Nitrogen Nucleus changes into:
(A) Oxygen (B) Carbon (C) Barium (Be) (D) Helium (He)

Topic IX: Nuclear Fission:

73. Nuclear fission chain reaction is controlled by using:
(A) Steel rods (B) Graphite rods (C) Cadimum rods (D) Platinum rods

74. Fission chain reaction is controlled by:-
(a) Cadmium rods (b) Iron rods (c) Platinum rods (d) Steel rods

75. Energy liberated when one atom of $^{235}_{92}U$ undergoes fission reaction:
(A) 140 Mev (B) 28 Mev (C) 200 Mev (D) 60 Mev

Topic X: Fusion Reaction:

76. The energy emitted from sun is due to:
(A) Fission reaction (B) Fusion reaction (C) Chemical reaction (D) Pair production

77. The energy released by fusion of two deuterons into a Helium nucleus is about:
(A) 24 Mev (B) 200 Mev (C) 1.02 Mev (D) 7.2 Mev

Topic XII: Biological Effects of Radiations:

78. The old and new units of absorbed doseare related by:
(A) 1 Gy = 10 rad (B) 1 Gy = 100 rad (C) 1 Gy = 1000 rad (D) 1 Gy = 10000 rad

79. Aging process of the human body is slowed by motion at very high speed i.e. according to:
(A) Newton (B) Einstein (C) Faraday (D) Coulomb

80. SI unit of absorbed dose is: (3 times)
(A) Gray (B) Roentgen (C) Curi (D) Rem

81. The most useful tracer isotope in agriculture is:
(A) Cobalt-60 (B) Carbon-14 (C) Iodine-131 (D) Strontium-90

82. The radiation used to diagnose diseases of eye is:
(A) Ultraviolet rays (B) X-rays (C) He-Ne laser (D) Radio waves

83. Device used to detect very weak magnetic field produced by brain is named as:
(a) MRI (b) CAT Scans (c) squid (d) CRO

84. Circulation of blood can be studied by using radioactive isotope: (2 times)
(a) Cobalt – 60 (b) phosphorus – 32 (c) Sodium – 24 (d) iodine – 131

Topic XIV: Basic Forces of Nature:

85. A particle is made up of two up quarks and one down quark is: (2 Times)
(A) Proton (B) Neutron (C) Boson (D) Lepton

86. Three up quarks combine to form a new particle, the charge on this particle is:
(A) 1 e (B) 2 e (C) 3 e (D) 4 e

87. Which of the following belong to "hadrons" group:
(A) Proton (B) Electron (C) Muons (D) Neutrinos

88. Curie is large unit which equals to _____ disintegration per second: (2 Times)
(A) 3.7×10^{10} (B) 3×10^{8} (C) 3.7×10^{8} (D) 3×10^{6}

89. Particles that experience the strong nuclear force:
(A) Hadrons (B) Leptons (C) Photons (D) Quarks

90. The particles equal in mass or greater than protons are called: (3 Times)
(A) Leptons (B) Baryons (C) Mesons (D) Mouns

91. A pair of quark and anti-quark make a: (4 Times)
(A) Meson (B) Harden (C) Lepton (D) Baryon

92. Every particle has corresponding antiparticle with:
(A) Same mass (B) Different mass
(C) Opposite charge (D) Same mass and opposite charge

93. Which group belongs to Hadrons: (3 times)
(A) Protons and neutrons (B) Muons and neutrons
(C) Photons and electrons (D) Positrons and electrons

94. The number of types of quarks is: (4 times)
(A) 6 (B) 5 (C) 4 (D) 3

95. Which of the followings are not hadrons?
(A) Muons (B) Mesons (C) Protons (D) Neutrons

96. One gray (Gy) is equal to:
(A) 1.6×10^{-19} J (B) $1.6\times10^{-10}\frac{J}{kg}$ (C) $1\frac{J}{kg}$ (D) $4\frac{J}{kg}$

97. Absorbed Dose "D" is defined as: (4 times)
(a) M/E (b) E/C (c) C/m (d) E/M

98. Two down and one up quark make:
(a) Proton (b) Neutron (c) Photon (d) Positron

99. A proton consists of quarks which are: (3 times)
(a) 2 up, 1 down (b) 1 up, 2 down (c) all up (d) all down

100. Which one is a better shield against $\gamma-rays$: (2 times)
(A) Wood (B) Lead (C) Aluminum (D) Water

101. In Wilson cloud chamber we used:
(A) Alcohol vapours (B) Neon gas (C) Bromine gas (D) Water vapours

102. The SI unit of Ryd berg constant is:
(A) m^{-2} (B) m^{-1} (C) NS (D) JS

103. The range of weak nuclear force is of the order of. (3 times)
(A) 10^{-10} m (B) 10^{-14} m (C) 10^{-17} m (D) 10^{-22} m

104. The building blocks of protons and neutrons are called:
(A) Ions (B) Electrons (C) Positrons (D) Quarks

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105. The bombardment of nitrogen with α-particle will produce: (2 times)
(A) Neutron (B) Proton (C) Electron (D) Positron

106. In Liquid Metal Fast Breeder reactor, the type of Uranium used is: (2 times)
(A) ${}^{235}_{92}U$ (B) ${}^{238}_{92}U$ (C) ${}^{234}_{92}U$ (D) ${}^{239}_{92}U$

107. If we have N_0 number of atoms of any Radioactive Element, then after four half lives, the number of atoms left behind is:

(A) $\frac{1}{4}N_0$ (B) $\frac{1}{8}N_0$ (C) $\frac{1}{16}N_0$ (D) $\frac{1}{2}N_0$

108. The half-life of radon gas is:

(A) 3.8 hours (B) 3.8 minutes (C) 3.8 days (D) 3.8 years

109. Bremsstrahlung radiations are example of:

(A) Atomic spectra (B) Molecular spectra (C) Continuous spectra (D) Discrete spectra

110. What is dfferent in isotopes:

(A) number of protons (B) number of neutrons (C) number of electrons (D) Charge number

111. The charge number of $^{141}_{56}Ba$ is:

(A) 197 (B) 141 (C) 85 (D) 56

112. The mass spectrum of naturally occurring neon shows the most abundant isotope has atomic mass:

(A) 19 (B) 20 (C) 21 (D) 22

113. The half-life of Radon is:

(a) 23.5 minutes (b) 3.8 days (c) 1620 years (d) 4.5×10^9 years

114. The particles which do not experience strong force are called:

(a) baryons (b) hadrons (c) mesons (d) leptons

115. The force which is responsible for the breaking up of the radioactive element, is: **(2 times)**

(a) weak nuclear force (b) strong nuclear force
(c) electromagnetic force (d) gravitational force

116. Hydrogen bomb is an example of:

(a) nuclear fission (b) Nuclear fusion (c) Chain reaction (d) Chemical reaction

117. Various types of cancer are treated by:

(a) carbon – 14 (b) Nickel – 63 (c) Cobalt – 60 (d) Strontium – 90

118. A pair of quark and anti quark makes: **(3 times)**

(a) Meson (b) Baryon (c) Lepton (d) Hadron

119. The Rest Mass Energy of an electron positron pair is:

(a) 0.51 Mev (b) 1.02 Mev (c) 1.2 Mev (d) 1.00 Mev

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120. In the reaction, $X + ^{17}_{8}O \rightarrow ^{14}_{7}N + ^{4}_{2}He$, X is:

(A) $^{1}_{1}H$ (B) $^{2}_{1}H$ (C) $^{0}_{1}e$ (D) $^{0}_{-1}e$

121. Binding energy per nucleon is maximum for:

(A) Helium (B) Iron (C) Radium (D) Polonium

122. 0.1 Kg mass will be equivalent to energy:

(A) 5×10^8 J (B) 9×10^{15} J (C) 6×10^{16} J (D) 9×10^{16} J

123. The specially designed solid state detector can be used to detect:

(A) α -rays only (B) β–rays only (C) γ-rays only (D) X-rays only

124. The binding energy per nucleon is maximum for: **(2 times)**

(A) Uranium (B) Platinum (C) Hydrogen (D) Iron

125. Radio Therapy is often used in the treatment of Cancer with.

(A) Iodine-131 (B) Sodium-34 (C) Carbon-12 (D) Cobalt-60

126. The existence of Positron was predicted by:

(A) G.P. Thomson (B) Dirac (C) Germer (D) Newton

127. 1 rem is equal to:

(A) 0.1 Sv (B) 0.01 Sv (C) 10 Sv (D) 100 Sv

128. Subatomic particles are divided into:

(A) Six groups (B) Five groups (C) Foru groups (D) Three groups

129. The quantity called the absorbed dose "D" is:
(A) E/m (B) E/C (C) m/C (D) C/E

130. Number of neutrons in $^{235}_{92}U$:
(A) 92 (B) 235 (C) 143 (D) 237

131. The binding energy per nucleon is maximum for:
(A) Hydrogen (B) Nitrogen (C) Uranium (D) Iron

132. By mass spectrograph we can find the value of mass by using formula:
(A) $m=\left(\frac{e^2r^2}{2V}\right)B^2$ (B) $m=\left(\frac{er^2}{2V}\right)B^2$ (C) $m=\left(\frac{eV}{2r^2}\right)B$ (D) $m=\left(\frac{eV^2}{2r}\right)B$

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133. In nuclear fission reaction, when the products are $^{140}X_{e}$ and ^{140}Sr, the number of neutrons emitted are :
(A) 1 (B) 2 (C) 3 (D) 4

134. Which of the following is highly pencetrating?
(A) α-particles (B) γ-rays (C) X-rays (D) β-particles

135. The temperature of the core of the sun is about :
(A) $5M^oC$ (B) $10M^oC$ (C) $20M^oC$ (D) $40M^oC$

136. In a Nuclear Transmutation when Thorium is transformed into Protactinium, the emitted particle is:
(A) A Beta Particle (B) A Neutron
(C) A proton (D) An Alpha Particle

137. Which of the following conservation law hold in nuclear transmutation.
(A) Mass (B) Energy (C) Momentum (D) All of these

138. The building blocks of protons and neutrons are:
(A) Ions (B) Electrons (C) Positrons (D) Quarks

139. Baryon with combination of up , up and up quark has charge
(A) 1 e (B) 2 e (C) -1 e (D) -2 e

140. $^{2}_{1}H+^{2}_{1}H \rightarrow ^{3}_{1}H+X+4.0$ Mev. The particle X is:
(A) $^{1}_{0}n$ (B) $^{1}_{1}H$ (C) $^{2}_{1}H$ (D) electron

141. Electron are :
(A) hadrons (B) leptons (C) quarks (D) baryons

142. In a nuclear transmutation, radium changes into radon, the emitted particle is:
(A) A neutron (B) A proton (C) An alpha particle (D) A beta particle

143. The average number of neutrons produced per fission of uranium-235 atom is:
(A) 2.5 (B) 3 (C) 2 (D) 4

144. Energy needed to create an electron-hole pair in a solid state detector is:
(A) 2-3eV (B) 3-4 eV (C) 4-5eV (D) 5-6eV

145. The energy released per unit mass is greater in:
(A) Fission reaction (B) Fusion reaction (C) Chemical reaction (D) Nuclear reaction

146. Leptons are particles do not experience:
(A) Strong Nuclear Force (B) Weak Nuclear Force
(C) Electric Force (D) Magnetic Force

147. In which nuclear detector, visible path of ionizing particle is shown:
(A) Wilson cloud chamber (B) GM Counter
(C) Solid State detector (D) All of these

148. The binding energy per nucleon is:
(A) Greatest for heavy nuclei (B) Least for heavy nuclei
(C) Greatest for light nuclei (D) Greatest for medium weight nuclei

ANSWERS OF THE MULTIPLE CHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
C	C	D	A	C	A	C	A	C	C	C	B	C	B	D	B
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	92
C	B	B	C	B	B	C	D	A	B	A	B	A	B	C	C
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
B	A	C	D	B	D	B	C	D	D	A	C	C	B	C	D

49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
D	D	D	C	A	D	A	D	D	B	D	A	A	D	B	B
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
D	A	B	D	D	A	C	A	C	A	C	B	A	B	B	A
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
B	C	C	C	A	B	A	A	A	B	A	D	A	A	A	C
97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112
D	B	A	B	A	B	C	D	B	B	C	C	C	B	D	B
113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128
B	D	A	B	C	A	B	A	B	B	C	D	D	B	B	D
129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144
A	C	D	B	B	B	C	A	D	D	B	B	B	C	A	B
145	146	147	148												
B	A	A	D												

SHORT QUESTIONS OF CHAPTER-21 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Atomic nucleus:

1. **In $^{235}_{92}U$, Find :**

(a) Atomic number **(b) Charge number**
(c) Number of neutrons **(d) Number of electrons**

Ans: (a) Atomic number Z = 92 (b) Charge number Z = 92
(c) Number of neutrons N = A – Z = 235 – 92 = 143 (d) Number of electrons = 92

Topic II: Isotopes:

2. **What are isotopes? What do they have common and what are their differences.** **(6 times)**

Ans: Isotopes are such nuclei of an element that have the same charge number Z but have different mass number A.
It means, in the nucleus the number of protons is the same but the number of neutrons is different.

3. **What are isotopes? Give an example.** **(4 times)**

Ans: Isotopes are such nuclei of an element that have the same charge number Z but have different mass number$A$.
For example, Hydrogen have 3 isotopes; Protium $_1H^1$, Deuterium $_1H^2$ & Tritium $_1H^3$.

4. **Write names of hydrogen isotopes with their formulas (symbols).** **(2 times)**

Ans: Three isotopes of hydrogen are:

(i) Protium ^1_1H

(ii) Deuterium ^2_1H

(iii) Tritium ^3_1H

Topic III: Mass Defect and Binding Energy:

5. **What do you mean by critical mass and critical volume?** **(8 times)**

Ans. The mass of uranium in which one neutron out of all neutron out of all neutron produced in one fission reaction produces further fission reactions is called critical mass.

6. **Define mass defect and binding energy.** **(14 times)**

Ans: __Mass defect:__ The mass of the nucleus is always less than the total mass of the protons and neutrons that make up the nucleus. The difference of the two masses is called mass defect.

__Binding energy:__ The missing mass is converted into energy at the formation of the nucleus and is called binding energy.

7. Show that 1 $u = 931\ MeV$ by using the relation $E = (\Delta m)c^2$. **(4 times)**

Ans: Since $1\ u = 1.66 \times 10^{-27} kg$

So

$$E = (\Delta m)c^2$$
$$E = (1.66 \times 10^{-27})(3 \times 10^8)^2$$
$$E = 14.94 \times 10^{-11}\ J$$
$$E = \frac{14.94 \times 10^{-11}}{1.6 \times 10^{-19}}\ eV$$
$$E = 931 \times 10^6\ eV$$
$$E = 931\ MeV$$

Hence $1\ u = 931\ MeV$

8. Explain the term mass defect. **(3 times)**

Ans: Mass defect: The mass of the nucleus is always less than the total mass of the protons and neutrons that make up the nucleus. The difference of the two masses is called mass defect.

9. How much energy released when 1 amu converted into energy?

Ans: $1\ amu = 1.66 \times 10^{-27}\ kg$

The energy of 1 amu is $1\ amu = 1.494 \times 10^{-10}\ J$

$$1\ amu = 931\ MeV$$

Topic IV: Radioactivity:

10. Why are heavy nuclei unstable? **(24 times)**

Ans: Heavy nuclei are unstable because their binding energy per nucleon is less than lighter nuclei. So less energy is required to break heavy nuclei and they become unstable.

11. What do you understand by Radio Activity? **(2 times)**

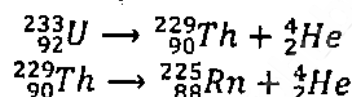
Ans: The elements having charge number Z > 82 are unstable and they emit invisible radiations which affect the photographic plate. Such elements are called radioactive elements and this process is called radioactivity.

12. Differentiate between parent and daughter element.

Ans: The change of an element into a new element due to emission of radiation is called radioactive decay. The original atoms is called parent element and the element formed due to this decay is called daughter element.

13. If U^{233}_{92} decays twice by α - emission what is the resulting isotope?

Ans: As

$$^{233}_{92}U \longrightarrow\ ^{229}_{90}Th +\ ^{4}_{2}He$$
$$^{229}_{90}Th \longrightarrow\ ^{225}_{88}Rn +\ ^{4}_{2}He$$

So, If $^{233}_{92}U$ decay twice by α – emission then it will be converted into $^{225}_{88}Rn$.

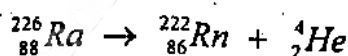
14. A particle, which produces more ionization, is less penetrating. Why?(15 times)

Ans. A particle with greater power loses large amount of energy for small distances. That is, it produces more ionization but is less penetration.

15. What is radioactive decay? Give an example. **(2 Time)**

Ans: The emission of radiations (such as α , β and γ) from elements having charge number Z greater than 82 is called radioactivity or **radioactive decay.**

The emission of an α – particle from radium – 226, results in the formation of radon gas $^{222}_{86}Rn$.

$$^{226}_{88}Ra \rightarrow\ ^{222}_{86}Rn +\ ^{4}_{2}He$$

16. Briefly explain what is meant by Quenching?

Ans: In G.M tube, a small amount of quenching gas (e.g bromine) having ionization potential lower than principal gas is mixed with the principal gas to prevent the emission of secondary electrons when positive ions strike the cathode. This is self – quenching. Electronic quenching is also in common practice.

17. What is natural radioactivity? Name types of radiations emitted from radioactive elements.

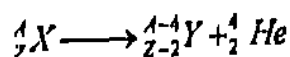
Ans: The emission of radiations from elements having charge number 'Z' greater than 82 is called natural radioactivity.

α – particle, β – particle and γ – rays are emitted from radioactive elements.

18. What will be the change in mass number and charge number during alpha decay?

Ans: The mass number of the nucleus decreases by 4, and the change number decreases by 2 during the emission of α – particle from any nucleus.

It is given by the equation.

$$_{Z}^{A}X \longrightarrow _{Z-2}^{A-4}Y + _{2}^{4}He$$

Topic V: Half Life:

19. Define decay constant. (3 times)

Ans: Decay constant of any element is equal to the fraction of the decaying atoms per unit time.

$$\lambda = -\frac{\Delta N/N}{\Delta t}$$

Its unit is s^{-1}.

20. The half-life of $_{38}^{91}S$, is 9.71 hour. Find its Decay constant.

Ans: Given that $T_{\frac{1}{2}} = 9.7\,h = 9.7 \times 3600\,s = 3.492 \times 10^4\,s$

$$\lambda = ?$$

Since $T_{\frac{1}{2}} = \frac{0.693}{\lambda}$

$$\lambda = \frac{0.693}{T_{\frac{1}{2}}}$$

$$\lambda = \frac{0.693}{3.492 \times 10^4}$$

$$\boxed{\lambda = 1.98 \times 10^{-5} s^{-1}}$$

21. What fraction of radioactive sample decays after two half-lives have elapsed? (7 times)

Ans: $number\ of\ atoms\ at\ initial\ stage = N_o$

$$number\ of\ atoms\ decayed\ after\ first\ half-life = \frac{1}{2}N_o$$

$$number\ of\ atoms\ decayed\ after\ two\ half-lives = \frac{1}{2}\left(\frac{1}{2}N_o\right)$$

$$number\ of\ atoms\ decayed\ after\ two\ half-lives = \frac{1}{4}N_o$$

$$Sototal\ number\ of\ atoms\ decayed = \frac{1}{2}N_o + \frac{1}{4}N_o = \frac{3}{4}N_o$$

$$fraction\ of\ atoms\ decayed = \frac{3}{4}N_o \times 100\% = 75\%$$

22. If nucleus has a half-life of one year, does this mean that it will be completely decayed after two years? Explain. (5 times)

Ans: No, it will not decay completely after two years.

$$number\ of\ atoms\ at\ initial\ stage = N_o$$

$$number\ of\ atoms\ decayed\ after\ first\ year = \frac{1}{2}N_o$$

$$number\ of\ atoms\ decayed\ after\ two\ years = \frac{1}{2}\left(\frac{1}{2}N_o\right)$$

$$\text{number of atoms decayed after two years} = \frac{1}{4} N_o$$

23. **What are the relation between decay constant λ and half-life $(T_{1/2})$ of a radioactive element?**

Ans: The relation between decay constant (λ) and half-life $\left(T_{\frac{1}{2}}\right)$ is $\lambda T_{\frac{1}{2}} = 0.693$

24. **Define half-life of a radioactive element and write its formula. (4 times)**

OR

Define Half Life of a Radioactive Element. What is the Relation between Half Life and Decay Constant?

Ans: The half-life $T_{\frac{1}{2}}$ of a radioactive element is that period in which half of the atoms decay. The relation between half-life and decay constant is

$$T_{\frac{1}{2}} \lambda = 0.693$$

25. **Define half-life and discuss its dependence.**

Ans: **Definition:** The half-life $T_{1/2}$ of a radioactive element is that period in which half of the atoms decay.

Dependence: The number of decaying atoms is proportional to the number of atoms present in the beginning of the period and is proportional to time interval.

Topic VI: Interaction of Radiation with matter:

26. **How α and β particles may ionize an atom without directly hitting the electrons? Explain. (3 times)**

Ans: As alpha and beta are electrically charged particles, so they can cause ionization without hitting an atom either by repelling or attracting the electron of target particles.

27. **Define fluorescence. Name two fluorescence substances.**

Ans: Fluorescence: Fluorescence is a property of absorbing radiant energy of high frequency and re-emitting energy of low frequency in the visible region of electromagnetic spectrum.

Some substances like zinc sulphide, sodium iodide and barium platinocyanide produce fluorescence.

28. **Describe a brief account of interaction of various types of radiations with matter. (4 times)**

Ans: **Interaction of α – particles with matter:**

i. An α – particle has a well-defined range in a medium, before coming to rest, which is called range of α – particle.
ii. It loses its energy (in medium) due to excitation and ionization of atoms and molecules in matter.
iii. α – particle ionizes by direct elastic collision or by electrostatic attraction.
iv. The range of α – particles depends upon the charge, mass, energy of the particle, density of the medium and ionization potentials of the atoms of the medium.
v. α – particle is about 7000 times massive than an electron, so it moves in a straight path.
vi. After coming to rest, α – particle captures two electrons from the medium and becomes a neutral helium atom.

Interaction of β-particles with matter:

i. The ionizing ability of β-particles is about 100 times less than that of α – particles.

ii. The range of β-particles is 100 times more than that of α – particles.

iii. Path of β-particles while passing through the matter is not straight.

iv. The range of β-particles depends upon the density of the matter. The more dense the matter is, shorter the range.

v. β-particles when slowed down by electric field of particles radiate energy as x-ray photons.

vi. B-particles produce fluorescence or glow on striking some substance like zinc sulphide, sodium iodine or barium platinocyanide coated screens.

Interaction of γ-rays with matter:

i. γ-raysare uncharged having zero rest mass, so they can't be stopped easily.

ii. Their ionizing power is very small but penetrating power is very high.

iii. γ-rays interact with matter in three different ways depending upon their energy.

Topic VII: Radiation Detectors:

29. Describe principle of operation of solid state detector. (4 Times)

OR Describe the principle of operation of a solid state detector of ionization radiation in terms of generation and detection of charge carriers.

Ans: The principle of operation of solid state detector is based upon the production of electron-hole pair to cause a pulse of current.

30. Write down two advantages of solid state detector over Geiger Muller Counter. (3 Times)

Ans: Solid state detector can count very fast than gas filled detector.

Solid state detector is much smaller in size.

It operates at low voltage.

31. What do you understand by "background radiation"? State two sources of this radiation. (16 times)

Ans: When no radioactive source is placed near the radiation detector, it records radiations. These radiations are called background radiations.

Its sources are i. Cosmic rays

ii. Presence of radioactive substances in Earth's crust and atmosphere

32. Why moderators are used in the core of nuclear reactor? (2 Time)

Ans: The moderators are used in the core to slow the neutrons down so that they can be captured and keep the chain reaction going.

33. What information if revealed by the length and shape of track of an incident particle in Wilson Cloud Chamber? (7 times)

Ans: In a Wilson Cloud Chamber

i. Alpha particles have larger mass and greater ionizing power, so its path is straight.

ii. Beta particles have less mass and less ionizing power, so its path is thinner, shorter and discontinuous.

iii. Gamma particles have no mass and high penetrating power, so its leaves no definite track along its path.

34. Briefly give the uses of (a) Wilson cloud chamber (b) G.M counter

Ans: Wilson Cloud Chamber

i. It provides information about the change in mass and energy of radiating particles.

G.M. Counter

i. It is used to determine the range and penetrating power of ionizing particles.

35. What is self-quenching in Geiger Muller Counter? (3 Time)

Ans: A small amount of gas (bromine or ethanol) is added into the GM counter is called self-quenching or internal quenching.

In GM counter the phenomenon of quenching is to save the counter from spurious or false counts.

36. What are thermal reactors?

Ans: The thermal reactors are called "thermal reactors" because the neutrons must be slowed down to thermal energies to produce further fission. They use natural uranium or slightly enriched uranium as fuel.

37. Why Geiger counter is not suitable for fast counting?

Ans: Geiger counter is not suitable for fast counting because of its longer dead time ($\approx 10^{-4}s$). The positive ions take several time as long to reach the outer cathode, because positive ions are very massive than the electrons. During this time further incoming particles cannot be counted. This time is called as the dead time of counter which delays fast counting system.

38. What is the function of control rods in nuclear reactor?

Ans: Control rods made of Cadmium or Boron are used for the control of number of neutrons, so that of all the neutrons produced in fission, only one neutron produces further fission reaction.
In case of emergency or for repair purposes control rods are used to stop the chain reaction and shut down the reactor.

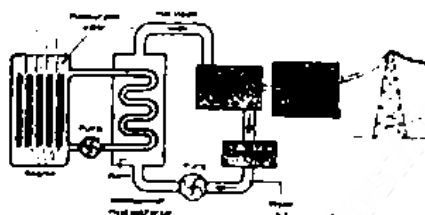
39. Why does a Geiger Muller Tube for detecting γ – rays not need a window at all?

Ans: For detecting γ – rays, a thin end window becomes useless because of the high penetrating power of γ – rays.

40. Write a short note on Geiger Muller Counter.

Ans: Geiger Muller Counter is a well known radiation detector. A high potential difference is applied between cathode and anode to attract ions produced by the interaction of radiation with principal or inert gas. Current pulse is amplified and registered electronically. Its dead time is equal to 10^{-4}s. A small amount of quenching gas having ionization potential lower than principal gas is mixed with principal gas to prevent the emission of secondary electrons when positive ions strike the cathode.
It is used to determine the range and penetrating power of ionizing particles.

41. What is the use of nuclear reactor and draw its diagram.

Ans: In a nuclear reactor fission reaction produces heat. This heat is used to produce steam which in turn rotates the turbine. Turbine rotates the generator which produces electricity.

Topic VIII: Nuclear Reactions:

42. Discuss the advantages and disadvantages of nuclear power compare to the use of fossil fuel generated power.

(2 times)

Ans: Advantages and disadvantages of nuclear power are given below compared to the use of fossil fuel generated power,

Advantages:

i. Much more energy is produced (i.e. 1kg of uranium = 2×10^7 kWh)
ii. Produces no environmental pollution.
iii. Electricity produced in this way is far cheaper than fossil fuel generated power.
iv. Nuclear waste can be re-used whereas used fossil fuel can't.

Disadvantages:

i. Uranium mining is more dangerous than coal mining.

ii. Nuclear waste can't be transported through areas of population whereas fossil fuel can be.
iii. Nuclear waste is very injurious and harmful to living things.

Topic IX: Nuclear Fission:

43. Define nuclear fission. Give two examples of such two reactions.

Ans: Such a reaction in which a heavy nucleus like that of uranium splits up into two nuclei of roughly equal size along with the emission of energy is called fission reaction.

For example $^{235}_{92}U + ^{1}_{0}n \rightarrow ^{132}_{50}Sn + ^{101}_{42}Mo + 3^{1}_{0}n + Q$

and $^{235}_{92}U + ^{1}_{0}n \rightarrow ^{140}_{54}Xe + ^{94}_{38}Sr + 3^{1}_{0}n + Q$

44. Differentiate between controlled and un-controlled chain reaction.

Ans: To maintain a sustained controlled nuclear reaction, for every 2 or 3 neutrons released, only one must be allowed to strike another uranium nucleus, it is called controlled chain reaction.

But if more than one neutron produces further fission then it will grow uncontrolled and called as uncontrolled chain reaction.

45. What do you mean by the term critical mass? **(7 times)**

Ans: The mass of uranium in which one neutron out of all neutron produced in one fission reaction produces further fission reactions is called critical mass. The volume of this mass of uranium is called critical volume.

46. Define fission and fusion reaction.

OR Distiguish between nuclear fission and fusion reaction.

Ans: **Fission:** Such a reaction in which a heavy nucleus like that of uranium splits up into two nuclei of roughly equal size along with the emission of energy is called fission reaction.

Fusion: A reaction in which two light nuclei merge to form a heavy nucleus is called fusion reaction. It requires very high temperature.

47. Discuss the advantages of fission power from the point of view of safety, pollution and resources. **(2 times)**

Ans: Advantages of nuclear power are given below

(i) Nuclear fission energy, releases a highly reduced amount of the gases into the air, resulting in a slower rate of global warming and pollution.
(ii) The energy is quick to create; meaning that they are able to make a large amount of some form of emergency required it.
(iii) While the initial building costs may be very high, the costs to operate a nuclear power plant are minimal.
(iv) Much more energy is produced

48. Write down two expected nuclear reactions for fission to indicate daughter nuclei.

Ans:

$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{132}_{50}Sn + ^{101}_{42}Mo + 3^{1}_{0}n + Q$$

$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{140}_{54}Xe + ^{94}_{38}Sr + 2\,^{1}_{0}n + Q$$

Here the products are daughter nuclei.

49. Explain briefly fission chain reaction. **(2 times)**

Ans: If only one neutron out of all the neutrons created in one fission reaction becomes the cause of further fission reaction. The other neutrons either escape out or are absorbed in any other medium except uranium. In this way, the fission chain reaction proceeds with its initial speed.

Topic X: Fusion Reaction:

50. What factors make a Fusion reaction difficult to achieve?

OR It is more difficult to start a fusion reaction than a fission reaction. Why? **(21 times)**

Ans: A fusion reaction requires large energy and temperature, up to million degrees centigrade. So a fusion reaction is difficult to achieve.

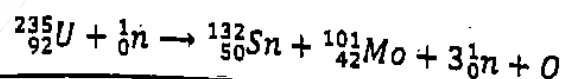
51. Distinguish between nuclear fission and nuclear fusion.

Ans: **Nuclear Fission:** Such a reaction in which a heavy nucleus like that of uranium splits up into two nuclei of roughly equal size along with the emission of energy is called fission reaction.

For example

$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{132}_{50}Sn + ^{101}_{42}Mo + 3^{1}_{0}n + Q$$

And

$$^{235}_{92}U + ^{1}_{0}n \longrightarrow ^{140}_{54}Xe + ^{94}_{38}Sr + 3^{1}_{0}n + Q$$

Nuclear Fusion: A reaction in which two light nuclei merge to form a heavy nucleus is called fusion reaction. It requires very high temperature.

52. **What is fusion reaction?**

Ans: **Nuclear Fusion Reaction:** A reaction in which two light nuclei merge to form a heavy nucleus is called fusion reaction. It requires very high temperature.

Topic XI: Radiation Exposure:

53. **State the advantages and disadvantages of nuclear power.**

Ans: Advantages and disadvantages of nuclear power are given below

Advantages:

i. Much more energy is produced (i.e. 1kg of uranium = 2 x 10^7 kWh)
ii. Produces no environmental pollution.
iii. Electricity produced in this way is far cheaper than fossil fuel generated power.
iv. Nuclear waste can be re-used whereas used fossil fuel can't.

Disadvantages:

iv. Uranium mining is more dangerous than coal mining.
v. Nuclear waste can't be transported through areas of population whereas fossil fuel can be.
vi. Nuclear waste is very injurious and harmful to living things.

Topic XII: Biological Effects of Radiations:

54. **How can radio activity help in the treatment of cancer?** **(20 Times)**

Ans: It helps in the treatment of cancer as

i. Cobalt-60 is used in radiotherapy.
ii. Radioactive iodine-131 is used to cure cancer of thyroid gland.
iii. For skin cancer, phosphorous-32 or strontium-90 is used.

55. **If you swallowed a α source and β source, which would be more dangerous to you? Explain.** **(8 times)**

Ans: As alpha particles have greater energy and ionizing power than beta particles, so alpha particles are more dangerous than beta particles.

56. **What is radioactive tracer? Give its one application each in industry and medicine.** **(6 times)**

Ans: Radioactive tracer is a radioactive isotope which acts as an indicator or tracer that makes it possible to follow the course of a chemical or biological process. They are used in

i. Medicine to detect malignant tumors.
ii. In industry to identify faults in the underground pipes.

57. **Briefly describe the term radiography.**

Ans: The radiography is a technique used in medicine such as internal imaging of the brain to determine the size and location of the tumor precisely.

58. **State two of the characteristics of β particle.**

Ans: They are negatively charged particles.
Their penetration power is high.

59. **Which radiation dose would deposit more energy to the body (a) 10m Gy to the hand (b) 1m Gy dose to entire body.** **(5 times)**

Ans: Since

$$absorbed\ dose = D = \frac{energy}{mass}$$

$$energy = D \times mass$$

Since the mass of whole body is much greater than the mass of hand. Therefore $1\,Gy$ dose given to the entire body deposit more energy.

60. **Write any two uses of radiography.**

Ans: (i) The γ – rays radiographs are used in medical diagnosis such as to determine precisely the size and location of a tumor in brain or other parts of body.

(ii) Cracks or cavities in castings or pipes can be detected by scanning.

61. **What is radioactive tracer? Describe one application in medicine and agriculture.**

Ans: Radioactive tracer is a radioactive isotope which acts as an indicator or tracer that makes it possible to follow the course of a chemical or biological process. They are used in

(i) Medicine to detect malignant tumors.
(ii) Agriculture to study the uptake of a fertilizer by a plant.

Topic XIV: Basic Forces of Nature:

62. Differentiate between Baryons and Mesons. **(5 times)**

Ans: Baryons: The particles equal in mass or greater than protons are called baryons. It is made by 3 quarks.

Mesons: The particles which are lighter in mass than protons are called mesons. A pair of quark and an antiquark makes a meson.

63. Give the names and charges of Quarks.

OR Name different quarks according to Gell-Mann and G.Zweig quark theory.

Ans: The names and charges of quarks are as follows

Name	*Symbol*	*Charge*
Up	u	$+\frac{2}{3}e$
Down	d	$-\frac{1}{3}e$
Strange	s	$-\frac{1}{3}e$
Charm	c	$+\frac{2}{3}e$
Top	t	$+\frac{2}{3}$
Bottom	b	$-\frac{1}{3}e$

64. Protons and neutrons are formed by what type of quarks? Show the diagram.

Ans: Proton is formed by two up and one down quarks.

u u
d

Neutron is formed by two down and one up quarks.

u d
d

65. Name the basic forces of nature. **(12 times)**

Ans: The basic forces of nature are

i. Gravitational force ii. Electromagnetic force iii. Weak nuclear force
iv. Strong nuclear force

66. What do you mean by quark? **(2 times)**

Ans: Quark is the basic building block of mesons and baryons. In actual, it is the basic building block of matter. It is proposed by Murray Gell-Mann and G. Zweig. It is of six types: up, down, strange, charm, bottom and top.

67. Define (a) Absorbed dose (b) Gray **(3 Time)**

Ans: Absorbed dose: it is defined as the amount of energy absorbed from an ionizing radiation per unit mass of the absorbing body i.e.

$$Absorbed\ Dose = \frac{energy\ absorbed}{mass}\ , \quad D = \frac{E}{m}$$

Gray: it is defined as the amount of energy equal to one joule absorbed by a body of mass 1kg. i.e.,

$$1\ \text{Gray} = \frac{1\ \text{Joule}}{1\ \text{kg}}\ , \quad 1\ \text{Gy} = 1\ \text{J kg}^{-1}$$

68. Write down the names of different Quarks.

Ans: The names of quarks are as follows

Up, Down, Strange, Charm, Top, Bottom

69. What are hadrons? Give one example. **(2 times)**

Ans: Hadrons: These are not elementary particles. They are composed of other elementary particles called quarks. The examples of hadrons are protons, neutrons, mesons etc. They experience strong nuclear force.

70. What are Hadrons and Laptons? Explain with examples.

OR Differentiate between Hadrons and Laptons. **(5 times)**

Ans: Hadrons: These are not elementary particles. They are composed of other elementary particles called quarks. The examples of hadrons are protons, neutrons, mesons etc. They experience strong nuclear force.

Laptons: These are elementary particles. They do not experience strong nuclear force. The examples of laptons are electrons, muons and neutrinos etc.

71. **What is meant by dose of radiation? What is its SI unit?**

Ans: Radiation dose is a measure of the amount of exposure to radiation. There are three kinds of dose:

(i) **Absorbed dose:** It is the amount of energy deposited by radiation in a mass.

$$D = E/m.$$

Its SI unit is Gy.

(ii) **Equivalent dose:** It is calculated for individual organ.

$$D_e = D \times RBE$$

Its SI unit is Sv.

(iii) **Effective dose:** It is calculated for the whole body. It is also measured in Sv.

72. **What are Leptons? Write its examples.**

(iv) Ans: Leptons are elementary particles. They do not experience strong nuclear force.

(v) The examples of Leptons are electrons, muons, and neutrinos etc.

73. **Define hadrons. Also differentiate between baryons and mesons. (2 times)**

Ans: **Hadrons** are composed of other elementary particles which are called quarks. They experience strong nuclear force. Protons, neutrons, mesons etc. are all hadrons.

The particles equal in mass or greater than protons are called **baryons.** They are made by three quarks.

The particles which are lighter in mass than protons are called **mesons.** A pair of quark and an antiquark makes a meson.

2021

74. **Write the name of two main types of nuclear reactors.**

Ans: **Thermal reactors:** The thermal reactors are one in which moderator are used to slow down the fast neutrons to thermal energies so that they can produce further fission either natural or enriched uranium is used as fuel in it.

Fast reactor: The reactors in which natural uranium is used as fuel which is nearly 99% of uranium, fast neutron can produce fission, so moderators are not required in fast reactors.

75. **Discuss the advantages and disadvantages of fission power from the point of view of safety, pollution and resources. (2 Times)**

Ans: **Advantages:**

(i) Nuclear fission energy, releases a highly reduced amount of the gases into the air, resulting in a slower rate of global warming and pollution.

(ii) The energy is quick to create; meaning that they are able to make a large amount of some form of emergency required it.

(iii) While the initial building costs may be very high, the costs to operate a nuclear power plant are minimal.

(iv) Much more energy is produced

Disadvantages:

The fusion reaction requires temperature up to million degree centigrade and high energy. These requirements are very difficult to achieve.

76. **Why is the mass of a nucleus less than the total mass of constituent particles? Where is this lost?**

Ans: The mass of the nucleus is always less than the total mass of the constituent particles that make up the nucleus because energy is removed when the nucleus is formed. This energy has mass, which is removed from the total mass of the original particles. The difference of the two masses is called mass defect. The missing mass is converted into energy at the formation of the nucleus and is called binding energy.

77. For what purpose, bromine is mixed with principle gas in Geiger tube?

Ans: Bromine provides quenching and stability to low-voltage principle gas in Geiger tube.

Explanation:
The quenching gas must have an ionization potential lower than that of principle gas (inert gas). Thus the ions of quenching gas reach the cathode before principal gas ions. When they reach near the cathode, they capture electrons and become neutral molecules. For example, Bromine gas is added to neon gas. The bromine molecules absorb energy from the ions of secondary electrons and dissociate into bromine atoms. The atoms then readily recombine into molecules again for the next pulse. The gas quenching is called self quenching.

78. What is fission chain reaction?

Ans: We have observed that during fission reaction, a nucleus of uranium-235 absorbs a neutron and breaks into two nuclei of almost equal masses besides emitting two or three neutrons. By properly using these neutrons fission reaction can be produced in more uranium atoms such that a fission reaction can continuously maintain itself. This process is called fission chain reaction.

LONG QUESTIONS OF CHAPTER-21 IN ALL PUNJAB BOARDS 2011-2021

Topic II: Isotopes:

1. Describe Aston's mass spectrograph. How can it be used for the detection of isotopes? **(5 times)**
2. Define isotopes. Write a note on mass spectrograph.
3. Explain how we can separate the isotopes of an element with the help of mass Spectrograph.

Topic III: Mass Defect and Binding Energy:

4. Explain mass effect and binding energy. **(2 Times)**
5. Define mass defect and binding energy. Write their expressions. Draw binding energy per nucleon curve. **(2 Times)**

Topic IV: Radioactivity:

6. What is radioactivity? Explain the nuclear transmutation.
7. What is radioactivity? Discuss emission of α, β and γ particles from radioactive nuclei. **(4 Times)**

Topic VII: Radiation Detectors:

8. Describe the construction and working of Geiger Muller Counter. **(2 times)**
9. What is nuclear reactor? Draw its diagram and describe function of its main parts.
10. Describe the principle, construction and working of a Wilson cloud chamber. **(5 times)**
11. Define and explain the principle, construction and working of a solid state detector. **(2 times)**
12. What is nuclear reactor? Explain different parts of power reactor.
13. Explain principle, construction and working of a Nuclear reactor. **(3 times)**
14. What is a nuclear reactor? Describe its four important parts. **(3 times)**

Topic IX: Nuclear Fission:

15. What is Nuclear Fission? Explain Fission Chain Reaction in detail.
16. Why nuclear fission reaction considered as a chain reaction? How can it be controlled?
17. What is fission chain reaction? Describe controlled and uncontrolled fission chain reaction.
18. Write a note on nuclear fission.
19. Define and explain nuclear fission.

Topic X: Fusion Reaction:

18. What is nuclear fusion? Why this reaction has not been brought under control? How sun is issuing out tremendous amount of energy?
19. Define and explain the Fusion Reaction with examples. **(2 times)**

NUMERICAL PROBLEMS OF CHAPTER-21 IN ALL PUNJAB BOARDS 2011-2021

Topic III: Mass Defect and Binding Energy:

1. Find the mass defect and binding energy of Tritium, if the atomic mass of Tritium is $3.016049\ u$. **(6 Time)**

Ans: Given that $atomic\ mass\ of\ tritium = m_t = 3.016049\ u$

$$atomic\ mass\ of\ proton = m_p = 1.007276\ u$$
$$atomic\ mass\ of\ neutron = m_n = 1.008665\ u$$
$$mass\ defect = \Delta m = ?$$
$$binding\ energy = B.E. = ?$$

Since $\Delta m = Zm_p + (A - Z)m_n - m_t$

$$\Delta m = 1(1.007276) + (3 - 1)(1.0086) - 3.016049 \boxed{= 0.008557\ u}$$

And $B.E. = \Delta m \times 931\ MeV = 0.008557 \times 931\ MeV \boxed{= 7.97\ MeV}$

2. Find the mass defect and binding energy of the deuteron nucleus. The experimental mass of deuteron is $3.3435 \times 10^{-27}\ kg$. **(5 times)**

Ans: Given that $mass\ of\ proton = m_p = 1.6726 \times 10^{-27} kg$

$$mass\ of\ neutron = m_n = 1.6749 \times 10^{-27} kg$$
$$mass\ of\ deutron = m_d = 3.3435 \times 10^{-27} kg$$
$$mass\ defect = \Delta m = ?$$
$$binding\ energy = B.E. = ?$$

Since $\Delta m = m_p + m_n - m_d$

$$\Delta m = 1.6726 \times 10^{-27} + 1.6749 \times 10^{-27} - 3.3435 \times 10^{-27}$$
$$\boxed{= 3.9754 \times 10^{-30}\ kg}$$

And $B.E. = \Delta m\, c^2$ $\quad B.E. = (3.9754 \times 10^{-30})(3 \times 10^8)^2$

$$\boxed{B.E. = 3.5729 \times 10^{-13}\ J}$$

$$B.E = \frac{3.5729 \times 10^{-13}}{1.6 \times 10^{-19}}\ eV$$

$$= 2.33 \times 10^6\ eV = 2.33\ MeV$$

3. Find the mass defect and binding energy for tritium, if the atomic mass of tritium is 3.016049 u. **(2 Time)**

Sol: Atomic mass of ^3_1H = m = 3.016049u.

$$\Delta m = ?$$
$$B.E = ?$$

As $\Delta m = [Zm_p + (A - Z)m_n] - m$

Putting values, we get

$$\Delta m = [1 \times 1.007276 + (3-1)1.008665] - 3.016049$$
$$= 1.007276 + 2.01733 - 3.016049$$
$$\Delta m = 0.00857u$$

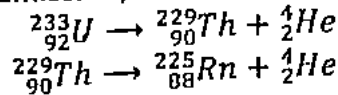
$B.E = \Delta m \times 931 \quad (\because 1u = 931\ Mev)$

Now $= 0.00857 \times 931$

$= 7.97\ MeV$

Topic IV: Radioactivity:

4. If $^{233}_{92}U$ decays twice by α −emission, what is the resulting isotope? (6 Time)

Ans: As

$$^{233}_{92}U \rightarrow {}^{229}_{90}Th + {}^{4}_{2}He$$
$$^{229}_{90}Th \rightarrow {}^{225}_{88}Rn + {}^{4}_{2}He$$

Semantically

> *If $^{233}_{92}U$ decays twice by α − emission then it will be converted into $^{225}_{88}Rn$.*

Topic V: Half Life:

5. A sheet of lead 5.0 mm thick reduces the intensity of a beam of γ-rays by a factor 0.4. Find half value thickness of lead sheet which will reduce the intensity to half of its initial value. (7 Times)

Sol:

$x_1 = 5.0mm \quad = 5\times10^{-3}m$

$I_1 = 0.4I_0$

$I_2 = 0.5I_0$

$x_2 = ?$

As $I = I_0e^{-\mu x}$

Thus $I_1 = I_0e^{-\mu x_1}$

$0.4I_0 = I_0e^{-\mu x_1}$

$0.4 = I_0 = I_0e^{-\mu x_1}$

Taking ln on both sides, we get

$\ln(0.4) = \ln e^{-\mu x_1}$

$\ln(0.4) = -\mu x_1$

$-\mu x_1 = -0.916$

$\mu x_1 = 0.916$ ________ (i)

$I_2 = I_0e^{-\mu x_2}$

$0.5I_0 = I_0e^{-\mu x_2}$

$0.5 = e^{-\mu x_2}$

$\ln(0.5) = \ln(e^{-\mu x_2})$

Similarly $-0.693 = -\mu x_2$

$\mu x_2 = 0.693 \rightarrow (ii)$

Dividing equation (i) by (ii)

$$\frac{\mu x_1}{\mu x_2} = \frac{0.916}{0.693}$$

$$\frac{x_2}{x_1} = \frac{0.693}{0.916}$$

$$x_2 = \frac{0.693}{0.916}x_1 = \frac{0.693}{0.916}\times5\times10^{-3} = 3.79\times10^{-3}m = 3.79mm$$

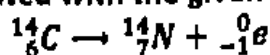
6. The half-life of $^{91}_{38}Sr$ is 9.7 *hours*. Find its decay constant. (8 times)

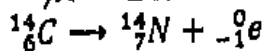
Ans: Given that $T_{\frac{1}{2}} = 9.7\,h = 9.7\times3600\,s = 3.492\times10^4\,s$

$\lambda = ?$

Since
$$T_{\frac{1}{2}} = \frac{0.693}{\lambda}$$
$$\lambda = \frac{0.693}{T_{\frac{1}{2}}}$$
$$\lambda = \frac{0.693}{3.492 \times 10^4} \boxed{= 1.98 \times 10^{-5} s^{-1}}$$

Topic VIII: Nuclear Reactions:

1. Determine the energy associated with the given reaction:
$${}^{14}_{6}C \longrightarrow {}^{14}_{7}N + {}^{0}_{-1}e$$

Given masses of
$${}^{14}_{6}C = 14.0077\ u \quad ; \quad {}^{14}_{7}N = 14.0031\ u \quad ; \quad {}^{0}_{-1}e = 0.00055\ u$$

Ans: The reaction is ${}^{14}_{6}C \longrightarrow {}^{14}_{7}N + {}^{0}_{-1}e$

Since
$$\Delta m = (m_{{}^{14}_{6}C}) - (m_{{}^{14}_{7}N} + m_{{}^{0}_{-1}e})$$
$$\Delta m = (14.0077) - (14.0031 - 0.00055)$$
$$\Delta m = 0.00405\ u$$

And $B.E. = \Delta m \times 931\ MeV$
$$B.E. = 0.00405 \times 931\ MeV = 3.77\ MeV$$

Topic XII: Biological Effects of Radiations:

1. A 75 kg person receive a hole body radiation dose of 24 $m - rad$, delivered by α particle for which RBE factor is 12. Calculate (5 times)
(a) the absorbed energy in joules (b) the equivalent dose in rem.

Ans: Given that
$$mass = m = 75\ kg$$
$$Dose = D = 24\ mrad = 24 \times 10^{-3}\ rad$$
$$= 24 \times 10^{-3} \times 0.01\ Gy$$
$$RBE = 12$$
$$absorbed\ energy = E = ?$$
$$equivalent\ dose = D_e = ?$$

Since
$$E = m \times D$$
$$absorbed\ energy = E = 75 \times 0.01 \times 24 \times 10^{-3}$$
$$absorbed\ energy = E = 18 \times 10^{-3}\ J \boxed{= 18\ mJ}$$

And
$$D = \frac{D_e}{RBE}$$
$$D_e = D \times RBE$$
$$= 24 \times 10^{-3} \times .01 \times 12$$
$$= 2.88 \times 10^{-3}\ Sv\ (\because 1\ rem = 0.01\ Sv)$$
$$= \frac{2.88 \times 10^{-3}}{0.01}\ rem \boxed{= 0.29\ rem}$$

2. How much energy is absorbed by a man of mass 80 kg, who receives a lethal whole body equivalent dose of 400 rem in the form of low energy neutrons for which RBE factor is 10?

Ans: $m = 80kg$

$RBE\ factor = 10$

$De = 400\ rem$

$= 400 \times 0.01 Sv = 4 Sv$

$E = ?$

As $D = \frac{De}{RBE} = \frac{4}{10} = 0.4 Gy$

Since $D = \frac{E}{m}$

Thus total energy absorbed by the whoel body

$E = mD$

$E = 80kg \times 0.4Gy$

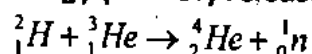
$E = 80 \times 0.4J$

$(\because 1Gy = 1JKg^{-1})$

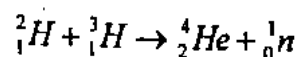
$E = 32J$

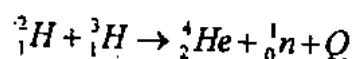
2021

10. Calculate the energy (In Mev) released in the following fusion reaction.

$${}_1^2H + {}_1^3He \rightarrow {}_2^4He + {}_0^1n$$

Given than

The given reaction is

$${}_1^2H + {}_1^3H \rightarrow {}_2^4He + {}_0^1n$$

Energy released $= \Delta E = ?$

According to reaction

$${}_1^2H + {}_1^3H \rightarrow {}_2^4He + {}_0^1n + Q$$

So $\Delta m =$ (Mass of ${}_1^2H$ + Mass of ${}_1^3H$) – (Mass of ${}_2^4He$ +Mass of ${}_0^1n$)

Since

Mass of ${}_1^2H = 2.014102u$

Mass of ${}_1^3H = 3.016050u$

Mass of ${}_2^4He = 4.002603\ u$

Mass of ${}_0^1n = 1.008665\ u$

Therefore:

$\Delta m = (2.014102 + 3.016050) - (4.002603 + 1.008665)$

$= 5.30152 - 5.011268$

$= 0.018884u$

Then $\Delta E = \Delta m \times 931$

$= 0.018884 \times 931$

$= 17.58\ MeV$

Energy released $\Delta E = 17.58\ MeV\ /\ event$

Board Papers 2019

SAHIWAL BOARD

Physics (New Scheme) (Group – I – Class 12th) Time : 20 Minutes
Session (2019) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **Frequency range in FM is:**
   (A) 540 KHz to 1600 KHz (B) 1000 KHz to 1600 KHz
   (C) 540 MHz to 1600 MHz (D) 88 MHz to 108 MHz
2. **Yttrium barium copper oxide ($YBa_2Cu_3O_7$) is superconductor at temperature:**
   (A) 163 K (B) 77 K (C) 4.2 K (D) 125 K
3. **If R_1 = 10 kΩ and R_2 = 1000 kΩ, then gain of inverting amplifier is:**
   (A) -11 (B) -10 (C) 10 (D) 11
4. **A p-n junction cannot be used as:**
   (A) amplifier (B) rectifier (C) detector (D) LED
5. **The angle of scattering for which the Compton shift is maximum, is:**
   (A) 180° (B) 90° (C) 45° (D) 0°
6. **If temperature is doubled for a black body, then energy radiated per second per unit area becomes:**
   (A) $\frac{1}{2}$ times (B) $\frac{1}{4}$ times (C) $\frac{1}{16}$ times (D) 16 times
7. **In spectrum of hydrogen, bracket series lies in:**
   (A) Ultraviolet region (B) Visible region
   (C) Infrared region (D) X-rays region
8. **Half life of radium-226 is:**
   (A) 1620 years (B) 3.8 days (C) 2.5 days (D) 23.5 minutes
9. **Binding energy per nucleus is maximum for:**
   (A) Helium (B) Iron (C) Radium (D) Polonium
10. **The number of electrons in one coulomb charge are equal to:**
    (A) 1.6×10^{-19} (B) 6.02×10^{-18} (C) 6.25×10^{20} (D) 6.25×10^{18}
11. **What is the force on a proton placed between two parallel plates containing equal positive charges:**
    (A) Zero (B) 2.6×10^{-19}N (C) 9×10^{-19}N (D) 5×10^{-19}N
12. **A resistor of resistance 'R' is cut into two equal parts of resistance R/2, its resistivity becomes:**
    (A) half (B) remains same (C) double (D) four times
13. **Magnetic field of 0.5 T is parallel to vector area of $1m^2$ of a coil, flux through the coil is:**
    (A) Zero (B) 5 web (C) 0.2 web (D) 0.5 web
14. **The brightness of spot in CRO is controlled by:**
    (A) Cathode (B) Anode (C) Grid (D) Deflecting plates
15. **The principle of an electric generator is based upon:**
    (A) Ampere's law (B) Faraday's law (C) Coulomb's law (D) Kirchhoff's law
16. **Energy stored in the inductor is in the form of:**
    (A) electrical energy (B) Magnetic energy
    (C) Kinetic energy (D) Chemical energy
17. **In a three phase A.C generator, if the phase of first coil is 0°, then the phase of other two coils will be:**
    (A) 120° and 120° (B) 120° and 160° (C) 120° and 240° (D) 120° and 360°

SAHIWAL BOARD

Physics (New Scheme) (Group-I, Class 12th) Time : 2:40 Hours
Session (2019) Subjective Marks : 68

2. Write short answers to any EIGHT parts.

i. A particle carrying a charge of 2 e falls through a potential difference of 3.0 V. Calculate the energy acquired by it.
ii. Write four properties of electric field lines.
iii. How can you identify that which plate of a capacitor is positively charged?
iv. Do electrons tend to go to region of high potential or of low potential?
v. State Ampere's Law and write its formula.
vi. Define Lorentz force and write its equation.
vii. Why does the picture on a T.V screen become distorted when a magnet is brought near the screen?
viii. Why the resistance of an ammeter should be very low?
ix. State Faraday Law of electromagnetic induction.
x. Define the term Henry.
xi. Does the induced e.m.f always act to decrease the magnetic flux through a circuit?
xii. Show that ε and $\frac{\Delta\phi}{\Delta t}$ have the same units.

3. Write short answer to any EIGHT parts.

i. How many electrons pass through an electric bulb in one minute if the 300 mA current is passing through it?
ii. Define drift velocity and also write its value at room temperature.
iii. What are the difficulties in testing whether the filament of a lighted bulb obeys Ohm's Law?
iv. What is the principle of generation of electromagnetic waves?
v. Name the device that will: (a) Permit flow of direct current but oppose the flow of alternating current. (b) Permit fiwo of alternating current but not the direct current.
vi. A choke coil placed in series with an electric lamp in an A.C circuit causes the lamp to become dim. Why is it so? A variable capacitor added in series, in this circuit may be adjected until the lamp glows with normal brilliance. Explain how this is possible.
vii. What do you mean by hysteresis and hysteresis loss?
viii. How would you obtain N-type and P-type material from pure silicon? Illustrate it by schematic diagram.
ix. What do you meant by curie temperature? Write the curie temperature of iron?
x. The anode of a diode is 0.2 v positive with respect to its cathode. Is it forward biased?
xi. Why a photo diode is operated in reverse biased state?
xii. What do you mean by the terms, rectifier and rectification?

4. Write short answer to any SIX parts.

i. Why don't we observe a Compton effect with visible light?
ii. As a solid is heated and begins to glow. Why does first appear red?
iii. What is the condition of pair production? Briefly explain.
iv. What are the advantages of lasers over ordinary light:
v. What is meant by CAT-Scanner?
vi. What do we meant by critical mass?
vii. What fraction of a radioactive sample decays after two half – lives have elapsed?
viii. What is the use of nuclear reactor and draw its diagram.
ix. Define decay constant and write its unit.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5. (a) What is Wheatstone Bridge? How is used to determine the unknown resistance?.
(b) A particle having a charge of 20 electrons on it falls through a potential difference of 100 volt. Calculate the energy acquired.

6. (a) Derive the expression for torque on the current carrying coil in uniform magnetic field.
(b) A square coil of side 16 cm has 200 turns and rotates in uniform magnetic field of magnitude 0.05 T, If the peak e.m.f is 12 V, what is the angular velocity of the coil?

7. (a) What is operational amplifier? Derive the relation for the gain of an inverting amplifier.
(b) A 10 mH, 20 Ω coil is connected across 240 V and 180 /π Hz source. How much power does it dissipate?

8. (a) State the special theory of relativity with two postulates and explain any two results.
(b) A steel wire 12 mm in diameter is fastened to a log and is then pulled by tractor. The length of steel wire between the log and tractor is 11m. A force of 10000 N is required to pull the log. Calculate (a) the stress in the wire and (b) the strain in the wire ($E = 200\times10^9\ Nm^{-2}$) (c) How much does the wire stretch when the log is pulled.

9. (a) State postulates of Bohar's model of the hydrogen atom and then show that hydrogen atom has quantized radii.
(b) A sheet of lead 5.0 mm thick reduces the intensity of a beam of γ-rays by a factor 0.4. Find half value thickness of lead sheet which will reduce the intensity to half of its initial value.

D.G.K. BOARD

Physics (New Scheme) (Group – I –Class 12th) Time : 20 Minutes
Session (2019) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **Photocopier and Inkjet printer are the application of.**
   (A) Electricity (B) Electrostatics (C) Magnetism (D) Electromagnetism
2. **Selenium is:**
   (A) Insulator (B) Photoconductor
   (C) Conductor (D)First insulator than conductor
3. **Siemen is the unit of:**
   (A)Resistivity (B) Resistance (C) Conductivity (D) Conductance
4. **The sensitivity of Galvanometer can be increased by:**
   (A) Decreasing the area of coil (B) Decreasing the number of turns of coil
   (C) Increasing the magnetic field (D) Using a fine suspension
5. **If a charge at rest in a magnetic field then force on charges is:**
   (A) Zero (B) Maximum (C) $q(\vec{V}\times\vec{B})$ (D) $qVB\cos\theta$
6. **Mutual induction has a practical role in performance of the:**
   (A) A.C. Generator (B) D.C Generator (C) Transformer (D) Radio Choke
7. **Henry is S.I unit of:**
   (A) Current (B) Resistance (C) Flux (D) Self inductance
8. **In three phase voltage across any two lines is about:**
   (A) 220V (B) 230V (C) 400V (D) 430V
9. **At high frequency, the value of reactance of the capacitor in A.C. circuit is:**
   (A) Low (B)High (C) Zero (D) Medium
10. **A device used to detect very weak magnetic field produced by brain is named as?**
    (A) MRI (B) CAT Scans (C) Squid (D) CRO
11. **The size of base in transistor is:**
    (A) 10^{-9} m (B) 10^{-8} m (C) 10^{-7} m (D) 10^{-6} m
12. **The potential barrier for germanium at room temperature is:**
    (A) 0.3 volt (B) 0.5 volt (C) 0.7 volt (D) 0.9 volt
13. **Photo diode can turn its current on and off in:**
    (A) Micro-sec (B) Nano-sec (C) Pico-sec (D) Femto-sec
14. **Joule second is the unit of:**
    (A) Energy (B) Wien's constant (C) Boyles law (D) Plank's constant
15. **Photons emitted in inner shell transition are:**
    (A) Continuous X-rays (B) Discontinuous X-rays
    (C) Characteristic X-rays (D) Energetic X-rays
16. **0.1 Kg mass will be equivalent to energy:**
    (A) 5×10^{8} J (B) 9×10^{15} J (C) 6×10^{16} J (D) 9×10^{16} J
17. **S.I unit of absorbed dose is:**
    (A) Gray (B) Roentgen (C) Curie (D) Rem

D.G.K. BOARD

Physics (New Scheme) (Group - I, Class 12th) Time : 2:40 Hours
Session (2019) Subjective Marks : 68

2. Write short answers to any EIGHT parts.

i. Electic lines of force never cross. Why?
ii. Is E necessarily zero inside a charged rubber balloon in balloon is spherical? Assume that charge is distributed uniformly over the surface.
iii. Define electron volt (ev) and write its relation with joule.
iv. What is meant by EEG and ERG?
v. If a charged particle moves in a straight line through some region of space, can to say that the magnetic field in the region is zero.
vi. What should be the orientation of a current carrying coil in a magnetic field so that torque acting upon the coil is (a) Maximum (b) Minimum?
vii. What is Lorentz force? Write its formula.
viii. What is right hand rule to find the direction of the lines of force?
ix. Can a step-up transformer increase the power level? In a transformer, there is no transfer of charge from the primary to the secondary, How is, than the power transferred?
x. Is it possible to change both the area of the loop and the magnetic field passing through the loop and still not have an induced *emf* in the loop.
xi. What is back *emf* effect in motors.
xii. Name and define the factors responsible for power loss in transformer.

3. Write short answer to any EIGHT parts.

i. What are the uses of rheostat?
ii. Do bends in a wire affect its electrical resistance? Explain.
iii. A charge of 90 C passes through a wire in 1 hour and 15 minutes. What is the current in the wire?
iv. What is choke?
v. Name the device that will: (a) Permit flow of direct current but oppose the flow of alternating current (b) Permit flow of alternating current but not the direct current.
vi. A circuit contains an iron-cored inductor, a switch and a D.C. source arranged in series. The switch is closed and after an interval reopened. Explain why a spark jumps across the switch contacts.
vii. Define strain energy in deformed materials. Write its formula.
viii. Differentiate between intrinsic and extrinsic semiconductors.
ix. Define modulus of elasticity. Show that the units of modulus of elasticity and stress are the same.
x. Write applications of photo diode.
xi. What is the net charge on a n-type substance?
xii. Why ordinary silicon diodes do not emit light?

4. Write short answer to any SIX parts.

i. What are the measurements on which two observers in the relative motion will always agree upon.
ii. Can pair production take place in vacuum? Explain.
iii. What is photo cell? Give its two applications.
iv. Define excitation potential.
v. What is meant by a line spectrum? Explain how line spectrum can be used for identification of elements?
vi. What do we mean by the term Cristical mass?
vii. What are isotopes? What do they have in common and what are their differences?
viii. Differentiate between mass defect and binding energy.
ix. Explain the term absorbed dose and define its unit gray.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5. (a) State and explain the Ohm's law.
(b) A particle having a charge of 20 electrons on it fall through a potential difference of 100 volts, Calculate the energy acquired by it in electron volts (ev).

6. (a) How energy is stored in an Inductor? Derive relation for energy stored in an Inductor.
(b) A power line 10.0 m high carries a current 200 A. Find the magnetic field of the wire at the ground.

7. (a) What is transistor? Derive the voltage gain equation of transistor working as an amplifier.
(b) An iron core coil of 2.0 H and 50 Ω is placed in series with a resistance of 450 Ω. An AC supply of 100 V, 50 Hz is connected across the circuit. Find the current flowing in the coil.

8. (a) What is meant by strain energy? Draw force extension graph for a vertically suspended wire stretched by a variable weight at the other end and by its graph derive a relation to calculate its value.
(b) What is the de-Broglie wave length of an electron whose kinetic energy is 120 ev?

9. (a) What are isotopes? How isotopes are separated by mass spectrograph? Also derive its relation.
(b) Calculate the longest wave length of radiation for the Paschen series.

GUJRANWALA BOARD

Physics (New Scheme) (Group – I – Class 12th) Time : 20 Minutes

Session (2019) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. Due to polarization, electric field E in a capacitor:
   (A) increases (B) decreases
   (C) first increases then decreases (D) remains same
2. If time constant in RC circuit is small, then capacitor is charged or discharged:
   (A) slowly (B) rapidly (C) at constant rate (D) intermittently
3. Kirchhoff's second rule is based on:
   (A) law of conservation of energy (B) law of conservation of mass
   (C) law of conservation of charge (D) law of conservation of momentum
4. S.I unit of magnetic permeability is:
   (A) $Wb\ A^{-1}\ m^{-1}$ (B) $Wb\ m^2$ (C) $Wb\ mA^{-1}$ (D) $Wb\ Am^{-1}$
5. When ohmmeter gives full scale deflection, it indicates,
   (A) Zero resistance (B) infinite resistance
   (C) small resistance (D) very high resistance
6. Lenz's law deals with the:
   (A) Magnitude of induced current (B) Direction of induced emf
   (C) Direction of induced current (D) magnitude of induced emf
7. When current flowing through an inductor is doubled, then energy stored in it becomes:
   (A) half (B) four times (C) one fourth (D) doubled
8. In a capacitive circuit of A.C quantity, when q=0, the slope of q – t curve is:
   (A) minimum (B) maximum (C) zero (D) negative
9. When A.C passes through an inductor, voltage leads the current by an angle:
   (A) 0° (B) 45° (C) 90° (D) 180°
10. In extrinsic semi-conductors, doping is of the order of:
   (A) 1 atom to 10^4 (B) 1 atom to 10^8 (C) 1 atom to 10^{16} (D) 1 atom to 10^6
11. The Boolean equation for exclusive NOR gate is given by:
   (A) $X = A.B + B.A$ (B) $X = A.\overline{B} + \overline{B}.A$ (C) $X = A.\overline{B} + \overline{A}.B$ (D) $X = A.\overline{B} + \overline{B}.A$
12. The potential barrier of silicon at room-temperature is:
   (A) 0.7 volt (B) 0.5 volt (C) 0.3 volt (D) 0.9 volt
13. The unit of work function is:
   (A) Volt (B) Joule (C) Watt (D) Farad
14. An electron in H-atom is excited from ground state to n=4, how many spectral lines are possible in this case?
   (A) 3 (B) 4 (C) 5 (D) 6
15. Metastable state is _______ than normal excited state:
   (A) 10^{-5} times larger (B) 10^{-8} times smaller
   (C) 10^{-8} times smaller (D) 10^5 times larger
16. A pair of quark and antiquark make a:
   (A) Meson (B) Hadron (C) Lepton (D) Baryon
17. The force which is responsible for the breaking up of the radioactive elements is:
   (A) Strong nuclear force (B) Gravitational force
   (C) Electromagnetic force (D) Weak nuclear force

GUJRANWALA BOARD

Physics (New Scheme) (Group-I, Class 12th) Time : 2:40 Hours
Session (2019) Subjective Marks : 68

2. Write short answers to any EIGHT parts.

i. Write any two properties of electric field lines.
ii. Differentiate beteeen electric potential and electric potential difference.
iii. Describe the force or forces on a positive point charge when placed between parallel plates with similar and equal charges.
iv. A particle having a charge of 20 electrons on it falls through a potential difference of 100 v. Calculate the energy acquired by it in electron volts (ev).
v. What is the function of grid in case of cathode ray oscilloscope?
vi. How can you prefer potentiometer over voltmeter?
vii. Why does the picture on a TV screen become distorted when a magnet is brought near the screen?
viii. A plane conducting loop is located in a uniform magnetic field that is directed along the x-axis. For what orientation of the loop is the flux a maximum? For what orientation is the flux a minimum?
ix. A metal rod of length 25cm is moving at a speed of $0.5ms^{-1}$ in a direction perpendicular to a 0.25 T magnetic field . find the emf produced in the rod.
x. State Lenz's Law and write its formula.
xi. How would you position a flat loop of wire in a changing magnetic field so that there is no emf induced in the loop?
xii. Four unmarked wires emerge from a transformer. What steps would you take to determine the turns ratio?

3. Write short answer to any EIGHT parts.

i. Do bends in a wire effect its electrical resistance? Explain.
ii. Define wheatstone bridge. Draw its circuit diagram.
iii. Distinguish between emf and terminal potential.
iv. Write the advantages and disadvantages of FM over AM.
v. A sinusoidal current has rms value of 10 A. What is the maximum or peak value?
vi. How does doubling the frequency affect the reactance of:
(a) An Inductor (b) A Capacitor
vii. Distinguish between elastic deformation and plstic deformation.
viii. Define stress and strain. What are their units?
ix. What is meant by strain energy? Write its formula.
x. How does the motion of an electron in an n-type substance differ from the motion of holes in a p-type substance?
xi. Why is the base current in a transistor very small?
xii. What is meant by a current gain of a transistor? Write its formula.

4. Write short answer to any SIX parts.

i. If the speed of light were infinite, what would the equations of special theory of relativity reduce to.
ii. Can pair production take place in vacuum? Explain.
iii. What are black body radiations?
iv. Bohr's theory of hydrogen atom is based upon several assumptions. Do any of these assumptions contradict classical physics?
v. Explain why laser action cannot occur without population inversion between atomic levels?
vi. What are isotopes? What do they have in common and what are their differences?
vii. How can radioactivity help in the treatment of cancer?
viii. Define mass defect and binding energy.
ix. What are leptons? Give an example.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5. (a) Define electric potential. Calculate the electic potential at the point due a point charge.
(b) The resistance of an iron wire at 0°C is $1\times10^{4}\,\Omega$. What is the resistance at 500 °C. If the temperature coefficient of resistance of iron is $5.2\times10^{-3}K$?
6. (a) State Ampere's law. Apply it to calculate the magnetic field due to current flowing through a solenoid.
(b) A coil of 10 turns and $35cm^2$ area is in a perpendicular magnetic field of 0.5T. The coil is pulled out of the field in 1.0s. Find the induced emf in the coil as it is pulled out of the field.
7. (a) Describe and explain the principle of generation, transmission and reception of electromagnetic waves.
(b)The current flowing into the base of a transistor is 100 uA. Find its collector current I_c, its emitter current I_E and the ratio $\frac{I_C}{I_E}$ if the valuf or current gain β is 100.?
8. (a) Define modulus of elasticity. Discuss its different types. Also give stress-strain curve of elastic limit and yield strength.
(b) Find the mass of a moving object with speed 0.8c.
9. (a) What is inner shell transition? Explain the production of x-rays.
(b) Find the mass defect and the binding energy for tritium, if the atomic mass of tritium is 3.016049u.

BAHAWALPUR BOARD

Physics (New Scheme) **(Group – I –Class 12th)** **Time : 20 Minutes**
Session (2019) **Objective** **Marks : 17**

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **The charge on the Droplet in Millikan Experiment is calculated by using formula:**
   (A) $q = \frac{mg}{vd}$ (B) $q = \frac{v}{mgd}$ (C) $q = \frac{mgd}{v}$ (D) $q = \frac{d}{mgd}$
2. **1 Ohm x 1 Farad is equal to:**
   (A) 1 Ampere (B) 1 Coulomb (C) 1 Joule (D) 1 Second
3. **Three Resistances 1 Ω, 2 Ω and 3 Ω are connected in series to a battery of 9 volts. The current flowing through each resistance will be:**
   (A) 1.5 A (B) 1.0 A (C) 0.5 A (D) 2.0 A
4. **Two Parallel Straight Wires carrying current in the same direction. Would they:**
   (A) Repel each other
   (B) Has Magnetic Field smaller than individual Magnetic Field
   (C) Attract each other
   (D) Has no effect upon each other
5. **The Force acting in a particle moving under the influence of both Electric and Magnetic Field is equal to:**
   (A) $F = F_e - Fm$ (B) $F = F_e + Fm$ (C) $F = F_e \times Fm$ (D) $F = F_e / Fm$
6. **An Inductor may store energy in:**
   (A) Outer Surface of Coil (B) Beyond of the coil
   (C) Its electric field (D) Its magnetic field
7. **If a conductor of length 1m is moved with Velocity V across a magnetic field B at an angle 30° with B, then the Motional emf will be:**
   (A) vBL (B) $\frac{1}{2}$vBL (C) $\frac{1}{2}$vB (D) 0.866 vB
8. **If the Angular Frequency of A.C. Generator increased to double, the time period would become:**
   (A) Double (B) 4 Times (C) $\frac{1}{4}$ Times (D) Half
9. **If we connect an ordinary D.C. Ammeter to measure alternating current, it would measure its value as:**
   (A) Instantaneous Value over a cycle (B) Peak to peak value
   (C) Averaged over a cycle (D) r.m.s. value
10. **The source of Magnetism of an atom is the orbital and spin motion of:**
    (A) Proton (B) Neutron (C) Positron (D) Electron
11. **The Central Region of a Transistor is known:**
    (A) Emitter (B) Collector (C) Depletion Region (D) Base
12. **The Resistance between (+) and (-) inputs of Operational Amplifier is:**
    (A) Very Low (B) Very High (C) Zero (D) Infinity
13. **In an expression for Time Dilation the quantity $\sqrt{1 - \frac{v^2}{c^2}}$ is always:**
    (A) Equal to Zero (B) Greater than One (C) Equal to One (D) Less than One
14. **In the process of Annihilation of Matter, the two Photons produced move in opposite direction to conserve:**
    (A) Energy (B) Mass (C) Momentum (D) Charge
15. **X-rays eject electrons from matter by:**
    (A) Pair Production (B) Annihilation of Matter (C) Compton Effect (D) Photoelectric Effect
16. **When a Nucleus emits Alpha Particle, the charge number decreases by:**
    (A) 2 (B) 3 (C) 4 (D) 5
17. **Radio Therapy is often used in the treatment of Cancer with.**
    (A) Iodine-131 (B) Sodium-34 (C) Carbon-12 (D) Cobalt-60

BAHAWALPUR BOARD

Physics (New Scheme) (Group -I, Class 12th) Time : 2:40 Hours
Session (2019) Subjective Marks : 68

2. Write short answers to any EIGHT parts.

i. Is E necessarily zero Inside a charged rubber balloon if balloon is spherical? Assume that charge is distributed uniformly over the surface.
ii. Electric Lines of Force never cross, why?
iii. Define and explain Time Constant for a Cpacitor.
iv. Is it possible to orient a current carrying loop in a uniform magnetic field such that the loop will not tend to rotate? Explain.
v. A particle carrying a charge of 2e falls through a potential difference of 3.0V. Calculate the energy acqurired by it in Joule.
vi. If a charged particle moves in a straight line through some region of space, can you say that magnetic filed in the region is zero?
vii. What do you understand by the Sensitivity of Galvanometer?
viii. What is the unit of Magnetic Induction 'B'? Define it.
ix. Is it possible to change both the area of the loop and the magnetic field passing through the loop and still not have an induced emf in the loop?
x. Can an electric motor be used to drive an electric generator with the output from the generator being used to operate the motor?
xi. What is meant by Efficiency of Transformer? Write few steps to improve the efficiency of Transformer.
xii. Does Induced emf always act to decrease the Magnetic Flux through a circuit?

3. Write short answer to any EIGHT parts.

i. Is the filament resistance lower or higher in a 500 W, 220V bulb than in a 100W, 220V bulb?
ii. Describe a Circuit which will give a continuously varying potential.
iii. What is Short Circuit and Open Circuit mean to you?
iv. What is meant by A.M. and F.M?
v. How does doubling the frequency affect the reactance of an : (a) An Inductor (ii) A Capacitor.
vi. Why is Power dissipated zero in Pure Inductive and Pure Capacitive Circuit?
vii. Distinguish between Amorphous and Polymeric Solids.
viii. What is meant by Hysteresis Loss? How is it used in the construction of a transformer?
ix. Defien Yield Point and Ultimate Tensile Stress.
x. What is the Net Charge on a n-type or a p-type substance?
xi. Why ordinary silicon diode do not emit light?
xii. Define Open Loop gain of an operational amplifier? Also write its formula.

4. Write short answer to any SIX parts.

i. What advantages an Electron Microscope has over an Optical Microscope?
ii. Can pair production take place in Vacuum? Explain.
iii. Why must the rest mass of photon be zero?
iv. What do we mean when we say that atom is excited?
v. Write down four applications of Laser.
vi. What do you understand by Background Radiation? State two sources of this Radiation.
vii. What do we mean by the term "Critical Mass"?
viii. Defien Radioactivity and Half Life.
ix. Show that 1 amu = 931 Mev.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5. (a) Define Capacitance. Derive an expression for capacitance of Parallel Plate Capacitor when a dielectric material is inserted between the Plaets.
(b) A Rectangular Bar of Iron is 2.0 cm by 2.0 cm in Cross-Section and 40 cm long. Calculate its Resistance if the Resistivity of Iron is 11×10^{-8} Ωm.

6. (a) Define Motional emf. Derive its relation with diagram.
(b) A Galvenometer having an Internal Resistance R_g=15.0 Ω gives full scale deflection with current I_g= 20.0 mA. It is to be converted into an Ammeter of range 10.0 . Find the value of Shunt Resistance R_s.

7. (a) What is Rectification? Explain in detail the Half –Wave Rectification.
(b) 100 μF Capacitor is connected to an Alternating Voltage of 24 V and Frequency 50 Hz. Calculate the Reactance of the Capacitor.

8. (a) What is Photoelectric Effect? Explain the Photoelectric Effect and derive the Einstein's Photoelectric Equation.
(b) 1.25 cm diameter cylinder is subjected to a load of 2500 Kg. Calculate the stress on the bar in Mega Pascals.

9. (a) What is Nuclear Reactor? Explain its working.
(b) A tungsten target is struck by electrons that have been accelerated from rest through 40 kV potential difference. Find the shortest Wavelength of the Bremsstrahlung Radiation emitted.

MULTAN BOARD

Physics (New Scheme)
Session (2019)

(Group – I – Class 12th)
Objective

Time : 20 Minutes
Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **The relation for Balmer Series Is written as:**
   (A) $\frac{1}{\lambda} = R_H\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$ (B) $\frac{1}{\lambda} = R_H\left(\frac{1}{3^2} - \frac{1}{n^2}\right)$
   (C) $\frac{1}{\lambda} = R_H\left(\frac{1}{4^2} - \frac{1}{n^2}\right)$ (D) $\frac{1}{\lambda} = R_H\left(\frac{1}{5^2} - \frac{1}{n^2}\right)$
2. **1 rem is equal to:**
   (A) 0.1 Sv (B) 0.01 Sv (C) 10 Sv (D) 100 Sv
3. **Subatomic particles are divided into:**
   (A) Six groups (B) Five groups (C) Foru groups (D) Three groups
4. **The study of electric charges at rest under the action of electric forces is known as:**
   (A) Electromagnetism (B) Electronstatics
   (C) Magnetic Induction (D) Electric field
5. **A particle carrying a charge of 2e falls through a potential difference of 3V:**
   (A) 9.6×10^{-18} J (B) 9.6×10^{-19} J (C) 1.6×10^{-19} J (D) 9.6×10^{-17} J
6. **Kirchhoff's 2nd rule is a manifestation of law of conservation of:**
   (A) Energy (B) Charge (C) Mass (D) Momentum
7. **Formula for magnetic field due to solenoid is given by:**
   (A) μ_o I (B) μ_o nI (C) μ_o SI (D) μ_o nI
8. **The value of permeability of free space 'μ_o' is:**
   (A) $4\pi \times 10^7$ Wb $A^{-1}m^{-1}$ (B) $4\pi \times 10^7$ Wb $A^{-1}m^{-1}$
   (C) $4\pi \times 10^{-7}$ Wb Am^{-1} (D) $4\pi \times 10^7$ Wb Am^{-1}
9. **The Lenz's Law is also a statement of:**
   (A) Law of Conservation of Momentum (B) Law of Conservation of Charge
   (C) Law of Conservation of Energy (D) Faraday Law of Electromagnetic Induction
10. **Electric current produces magnetic field was discovered by:**
    (A) Faraday (B) Maxwell (C) Oersted (D) Lenz
11. **The impedance of R-L series circuit is:**
    (A) $Z=\sqrt{R^2 + X_L^2}$ (B) $Z=\sqrt{R^2 + X_C^2}$ (C) $Z=\sqrt{R + X_L}$ (D) Z=R
12. **The capacitance required to construct a resonance circuit of frequency 1000 kHz with an inductor of 5mH is:**
    (A) 5.09 pF (B) 5.09 μF (C) 5.09mF (D) 50.9 pF
13. **Substances which undergro plastic deformation until they break are called:**
    (A) Brittle Substances (B) Non-magnetic Substances
    (C) Magnetic Substances (D) Ductile Substances
14. **The size of base of transistor is of the order of:**
    (A) 10^{-6} m (B) 10^{-5} m (C) 10^{-4} m (D) 10^{-3} m
15. **A two inputs NAND gate with inputs A and B has an output 'O' if:**
    (A) A is O (B) B is O
    (C) Both A and B are O (D) Both A and B are 1
16. **Compton wavelength is:**
    (A) $\frac{h}{m_o c^2}$ (B) $\frac{hc}{m_o}$ (C) $\frac{h}{m_o c}$ (D) $\frac{hc}{m_o \lambda}$
17. **The enegy required for pair production is:**
    (A) 0.51 MeV (B) 1.02 MeV (C) 2.04 MeV (D) 3.06 MeV

MULTAN BOARD

Physics (New Scheme) (Group-I, Class 12th) Time : 2:40 Hours
Session (2019) Subjective Marks : 68

2. **Write short answers to any EIGHT parts.**

i. Suppose that you follow an electric field line due to a positive point charge. Do electric field and the potential increase or decrease?
ii. Is it true that Guass's law states that the total number of lines of forces crossing any closed surface in the outward direction is proportional to the net positive charge enclosed within surface?
iii. What are the factors upon which the electric flux depend?
iv. Differentiate between electrical potential difference and electric potential at a point?
v. How can a current loop be used to determine the presence of a magnetic field in a given region of space?
vi. Why does the picture on a TV screen become distorted when a magnet is brought near the screen?
vii. What is galvanometer? One which principle it works?
viii. What is Magnetic Flux Density? Also write its unit.
ix. How would you position a flat loop of wire in a changing magnetic field so that there is no emf induced in the loop?
x. A suspended magnet is Oscillating freely in a horizontal plane. The Oscillations are strongly damped when a metal plate is placed under the magnet. Explain why does this occur?
xi. What is Transformer? What is its working principle?
xii. What is back emf in motors?

3. **Write short answer to any EIGHT parts.**

i. Why does the resistance of a conductor rise with temperature?
ii. Is the filament resistance lower or higher in a 500 W, 220V light bulb than in a 100 W, 220V bulb?
iii. State Kirchhoff's first rule and write its mathematical formula.
iv. How many times per second will an incandescent lamp reach maximum brilliance when connected to a 50 Hz source?
v. How does doubling the frequency affect the reactance of (a) an inductor (b) a capacitor
vi. Define impedance and write the impedance expression for R-L series circuits.
vii. Differentiate between Ductile and Brittle substances.
viii. How would you obtain n-type and p-type material from pure Silicon?
ix. Define Modulus of elasticity. Show that the units of Modulus elasticity and stress are the same.
x. Write two characteristics of Op-amplifier.
xi. How does the motion of an electron in a n-type substance differ from the motion of holes in a p-type substance?
xii. What is the effect forward and reverse biasing of a diode on the width of depletion region?

4. **Write short answer to any SIX parts.**

i. A particle of mass 5.0 mg moves with speed of 8.0 ms^{-1}. Calculate de Broglie wavelength.
ii. Why don't we observe a Compton effect with visible light?
iii. Which the lower energy quanta? Radiowaves or X-rays.
iv. Define Spectroscopy.
v. What are the advantages of Laser over ordinary light?
vi. Write the names of four basic forces of nature.
vii. What information is revealed by the length and shape of the tracks of an incident particle in Wilson Cloud Chamber?
viii. What do you understand by "background radiation"? Give two sources of this radiation.
ix. If a nucleus has a half-life of 1 (one) year, does this mean that it will be completely decayed after 2 years?

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5. (a) Define Electric Potential. Derive the relation of electric potential at a point due to point charge.
(b) A platinum wire has resistance of 10 ohm at 0°C and 20 ohm at 273°C. Find the value of temperature coefficient of resistance of platinum.

6. (a) Define Solenoid. Derive an expression for the energy stored per unit volume inside the solenoid.
(b) A power line 10.0m high carries a current 200A. Find the magnetic field of the wire at the ground.

7. (a) What are Electromagnetic Waves? Discuss principle of generation, transmission and reception of electromagnetic waves.
(b) The current flowing into the base of a transistor is 100 µA. Find its collector current I_C, its emitter current I_E and the ratio I_C/I_E if the value of current gain β is 100.

8. (a) What is meant by Strain Energy? How can it be determined from the force- extension graph?
(b) What is the maximum wavelength of the two photons produced when a positron annihilates an electron? The rest mass energy of each is 0.51 MeV.

9. (a) What are building blocks of matter? Explain.
(b) What is the energy in eV of quanta of wavelength of λ= 500 nm.

FAISALABAD BOARD

Physics (New Scheme) (Group – I –Class 12th) Time : 20 Minutes
Session (2019) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **The force on an electron in a field of 1×10^{8} NC^{-1} will be:**
   (A) 1.6×10^{-8}N (B) 1.6×10^{-11}N (C) 1.6×10^{-19}N (D) 1.6×10^{-27}N
2. **Electric flux is maximum, when angle between $\vec{E}$ and surface are is:**
   (A) 0° (B) 90° (C) 180° (D) 45°
3. **Heat generated by a 50 watt bulb in one hour is:**
   (A) 36000 J (B) 48000 J (C) 18000 J (D) 180000 J
4. **The relation $B=\frac{\mu_0 I}{2\pi r}$ is called:**
   (A) Ampere's law (B) Faraday's law (C) Lenz's law (D) Gauss's law
5. **The magnetic force on an electron, travelling at $10^{6}ms^{-1}$ parallel to the magnetic field of strength 1T is:**
   (A) 10^{-12} N (B) 10^{3} N (C) 0 (D) 16×10^{-12} N
6. **One of the applications of mutual induction is:**
   (A) Choke (B) Rectifier (C) Rheostat (D) Step up transfer
7. **Henry can be written as:**
   (A) VsA^{-1} (B) $Vs^{-1}A^{-1}$ (C) $Vs^{-1}A$ (D) $V^{-1}sA$
8. **In RLC series resonance circuit, at resonance frequency, impendance Z is:**
   (A) $\sqrt{R^2+X_L^2}$ (B) R (C) $\sqrt{R^2+X_C^2}$ (D) X_L
9. **Choke consumes extremely small:**
   (A) Current (B) Charge (C) Power (D) Potential
10. **A single domain in paramagnetic substance contains nearly:**
    (A) $10^{8}-10^{10}$ atoms (B) $10^{15}-10^{20}$ atoms
    (C) $10^{12}-10^{20}$ atoms (D) $10^{12}-10^{16}$ atoms
11. **$X = A.B$ is the mathematical notation for:**
    (A) NAND gate (B) OR gate (C) NOR gate (D) AND gate
12. **In a comparator circuit, when intensity of light decreases,then resistance or LDR:**
    (A) R_L increases (B) R_L decreases (C) V_R decreases (D) V_- increses
13. **If an electron is accelerated through a potential difference of 10 V, then energy gained by electron is:**
    (A) 1.6×10^{-20}J (B) 1.6 eV (C) 10 eV (D) 1.6×10^{-19}eV
14. **If velocity of a body becomes equal to "C", then its mass becomes:**
    (A) 0 kg (B) $m = m_0$ (C) $m \to \infty$ (D) $m=\frac{m_0}{2}$
15. **An electron can reside in the meta stable state for about:**
    (A) 10^{3}s (B) 10^{-8}s (C) 10^{8}s (D) 10^{-3}s
16. **Half life of Iodine-131 is 8 days and it weighs 20mg. after 4 half lives, the amoutn left behind will be:**
    (A) 2.5 mg (B) 1.25 mg (C) 0.625 mg (D) 0.312 mg
17. **Which group belongs to Hadrons?**
    (A) Protons and neutrons (B) Mesons and neutrinos
    (C) Photons and electrons (D) Positrons and electrons

FAISALABAD BOARD

Physics (New Scheme) (Group -I, Class 12th) Time : 2:40 Hours
Session (2019) Subjective Marks : 68

2. Write short answers to any EIGHT parts.

i. Define potential gradient and show that $E = -\frac{\Delta V}{\Delta r}$.
ii. Write two differences between electrical and gravitational forces.
iii. How can you identify that which plate of a capacitor is positively charged?
iv. Suppose that you follow an electric field line due to positive point charge. Do electric field and the potential increase or decrease?
v. What do you know about sensitivity of galvanometer?
vi. What are the uses of CRO?
vii. How can you use a magnetic field to separate isotopes of chemical elements?
viii. Why the resistance of an ammeter shoulde be very low?
ix. What are the factors upon which the mutual inductance depends?
x. What is the back motor effect in generators?
xi. Four unmarked wires emerge from a transformer. What steps would you take to determine the turns ratio?
xii. Show that ε and $\frac{\Delta \phi}{\Delta t}$.

3. Write short answer to any EIGHT parts.

i. State the Kirchhoff's first and second rule.
ii. Is the filament resistance lower or higher in a 550W, 220V light bulb than in a 100W, 220V bulb?
iii. What is meant by the tolerance in a ersistaor? Write the value of tolerance of silver and gold.
iv. What is a choke?
v. What is meant by AM and FM?
vi. A circuit contains an iron cored inductor, a switch and a DC source arranged in series. The switch is closed and after an interval reopened. Explain why a spark jumps across the switch contacts?
vii. Define diamagnetic and ferromagnetic substances. Give their examples.
viii. Distinguish between crystalline and amorphous solids.
ix. What is the mechanism of electrical conduction by holes and electrons in a pure semiconductor element?
x. Why ordinary silicon diodes do not emit light?
xi. Why charge carriers are not present in the depletion regions?
xii. What is solar cell? Give its uses?

4. Write short answer to any SIX parts.

i. What advantages an electron microscope has over an optical microscope?
ii. When does light behave as a wave? When does it behave like a particle?
iii. Calculate the value of Compton wave length of electron.
iv. Explain why laser action could not occur without population inversion between atomic levels?
v. How K_α and K_β X-rays are emitted?
vi. How can radioactivity help in the treatment of Cancer?
vii. What do you understand by background radiations? State two sources.
viii. Differentiate between Hadrons and Leptons.
ix. Write any two uses of radiography.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5. (a) What is capacitor? Derive a relation for the capacitance of parallel plate capacitor. Show that capacitance varies in the presence of dielectric between the plates of capacitor.
(b) The resistance of an iron wire at 0°C is $1 \times 10^4 \Omega$. What is the resistance at 500 °C if the temperature coefficient of resistance of iron is $5.2 \times 10^{-3} K^{-1}$?

6. (a) Explain the phenomena of mutual induction, mutual inductance and define its units.
(b) Alpha particles ranging in speed from $1000 ms^{-1}$ to $2000 ms^{-1}$ enter into a velocity selector where the electric intensity is $300 Vm^{-1}$ and the magnetic induction 0.20T. Which particle will move undeviated through the field?

7. (a) What is transistor? How it is used as an amplifier? Derive its voltage gain equation.
(b) At what frequency will an inductor of 1.0H have a reactance of 500Ω.

8. (a) Describe de-Broglie's hypothesis and explain Davisson and Germer experiment to confirm this hypothesis.
(b) What stress would cause a wire to increase in length by 0.01% if the Young's modulus of the wire is 12×10^{10}Pa. What force would produce this stress if the diameter of the wire is 0.56 mm?

9. (a) What is radioactivity? Discuss emission of alpha (α), beta (β) and gamma (γ) radioactive from radioactive nuclei.
(b) Compute the shortest wavelength radiation in the Balmer series. What value of "n" must be used"?

SARGODHA BOARD

Physics (New Scheme) **(Group – I –Class 12th)** **Time : 20 Minutes**
Session (2019) **Objective** **Marks : 17**

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **Types of quarks are:**
   (A) 2 (B) 4 (C) 6 (D) 8
2. **In liquid metal fast breeder reactor the type of uranium used is:**
   (A) $^{235}_{92}U$ (B) $^{238}_{92}U$ (C) $^{234}_{92}U$ (D) $^{239}_{92}U$
3. **The force between two charges is 28 N. The paraffin wax of relative permitivity 2.8 is introduced between the charges as medium then force reduces to:**
   (A) 25 N (B) 20 N (C) 10 N (D) 15 N
4. **A charge of 10^{-10} C between two parallel plates 1 cm apart experience a force of 10^{-5} N. The p.d. between the plates is:**
   (A) 10 V (B) 10^2 V (C) 10^3 V (D) 10^4 V
5. **Tolerance for silver colour is:**
   (A) ± 10% (B) ± 15% (C) ± 20% (D) ± 5%
6. **Two parallel wires carrying currents in opposite direction:**
   (A) Repel each other (B) Attract each other
   (C) Neither attract nor repel (D) Stick to each other
7. **A 5m wire carrying current 2 A at right angle to uniform magnetic field of 0.5 T. The force on the wire is:**
   (A) 1.5 N (B) 5 N (C) 2.5 N (D) 4 N
8. **If the coil is wound on iron core, the flux through it:**
   (A) Decreases (B) Becomes zero (C) Remains constant (D) Increases
9. **Energy stored per unit volume in magnetic field is called:**
   (A) Energy density (B) Electric flux (C) Work (D) Power
10. **S.I unit of reactance is:**
    (A) Farad (B) Volt (C) Ampere (D) Ohm
11. **The device which allows only the flow of D.C. is:**
    (A) Capacitor (B) Resistor (C) Inductor (D) Generator
12. **A vacant or partially filled band is called:**
    (A) Fermi Band (B) Valence Band (C) Forbidden Band (D) Conduction Band
13. **For normal operation of transistor, the Emitter-Base junction is always:**
    (A) Forward Biased (B) Reverse Biased (C) Unbiased (D) Grounded
14. **The S.I unit of current gain is:**
    (A) Volt (B) Ampere (C) Coulomb (D) No unit
15. **The factor $\frac{h}{m_o c}$ in Compton effect has the dimensions of:**
    (A) Pressure (B) Length (C) Mass (D) Momentum
16. **The materialization of energy takes place in the process of:**
    (A) Photoelectric effect (B) Compton effect
    (C) Pair production (D) Annihilation of matter
17. **Joule-Second is the unit of:**
    (A) Energy (B) Heat (C) Plank's constant (D) Power

SARGODHA BOARD

Physics (New Scheme) (Group-I, Class 12th) Time : 2:40 Hours
Session (2019) Subjective Marks : 68

2. Write short answers to any EIGHT parts.

i. Define Electrostatics and Xerography.
ii. Define Gaussian surface and Electric lines of force.
iii. The potential is constant through out a given region of spce. Is the electric field is zero or non-zero in this region? Explain.
iv. How can you identify that which plate of a capacitor is positively charged?
v. Define magnetic induction and Tesla.
vi. Define Magnetic Flux and Flux Density.
vii. Why the resistance of an ammeter should be very low?
viii. Why the voltmeter should have a very high resistance.
ix. Define electromagnetic induction and induced emf.
x. Define Mutual induction and Henry.
xi. Four unmarked wires emerge from a transformer. What steps would you take to determine the turns ratio?
xii. Can a D.C motor be turned into a D.C generator? What changes are required to be done?

3. Write short answer to any EIGHT parts.

i. What is wheatstone bridge? How can it be used to determine an unknown resistance?
ii. Is the filament resistance lower or higher in a 500 W, 220 V light bulb than in a 100W, 220V bulb?
iii. Define sources of current and give its two examples.
iv. Explain the conditions under which electromagnetic waves are produced from a source?
v. What is meant by A.M and F.M?
vi. What is choke? Explain.
vii. Explain the term Hysteresis.
viii. Define stress and strain. What are their SI units?
ix. What are superconductors? Write their types.
x. What is the biasing requirement of the junctions of a transistor for its normal operation? Explain how these requirement are met in a common emitter amplifier?
xi. The anode of a diode is 0.2 V positive with respect to its cathode. Is it forward biased?
xii. Write two characteristics of operational amplifier.

4. Write short answer to any SIX parts.

i. What advantages an electron microscope has over an optical microscope?
ii. Can pair production take place in vacuum? Explain.
iii. Find the energy of photon in radiowave of wavelength 100m.
iv. Define excitation energy and ionization energy.
v. Can X-rays be reflected, refracted, diffracted and polarized just like any other waves? Explain.
vi. Explain briefly fission chain reaction.
vii. How can radioactivity help in the treatment of cancer.
viii. Define hadrons. Also differentiate between baryons and mesons.
ix. What information is revealed by the length and shape of the tracks of an incident particle in Wilson cloud chamber?

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5. (a) What is electric potential? Find electric potential at a point due to a point charge.
(b) A rectangular bar of iron is 2.0 cm by 2.0 cm in cross section and 40 cm long. Claculate its resistance if the resistivity of iron is $11 \times 10^{-8} \Omega m$.

6. (a) What is A.C Generator. Discuss the principle, construction and working of an A.C Generator. Also find expression for induced emf and current.
(b) How fast must a proton move in a magnetic field of 2.50×10^{-3}T such that the magnetic force is equal to its weight?

7. (a) Describe R-L-C series circuit, derive the expression for its resonance frequency and write down its properties.
(b) In a certain circuit, the transistor has a collector current of 10mA and a base current of 40 μA. What is the gain of the transistor?

8. (a) What is Doping, Explain formation of n-type and p-type semiconductor.
(b) An electron is placed in a box about the size of an atom that is about 1.0×10^{-10}m. What is the velocity of the electron.

9. (a) What is nuclear reactor? Describe its principle, construction and working.
(b) The wavelength of K X-ray from copper is 1.377×10^{-10}m. What is the energy difference between the two levels from which this transition results.

LAHORE BOARD

Physics (New Scheme) (Group – I –Class 12th) Time : 20 Minutes

Session (2019) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. In p-type substances, the majority charge carriers are:
   (A) Electrons (B) Protons (C) Holes (D) Neutrons
2. Commutators are used in.
   (A) D.C. generators (B) A.C generators
   (C) A.C. motor (D) A.C. rotator
3. The factor $\frac{h}{m_o c}$ in Compton equation has the dimension of:
   (A) Pressure (B) Length (C) Mass (D) Momentum
4. Sec/Ohm is equal to.
   (A) Farad (B) Coulomb (C) Joule (D) Ampere
5. Number of neutrons in $^{235}_{92}U$:
   (A) 92 (B) 235 (C) 143 (D) 237
6. The sum of negative and positive peak values is:
   (A) Average value (B) rms value (C) Peak value (D) p-p value
7. The magnetic force is simply a:
   (A) Reflecting force (B) Restoring force (C) Deflecting force (D) Gravitational force
8. If a charged body is moved against the electric field, it will gain:
   (A) P.E. (B) K.E. (C) Mechanical energy
   (D) Electrical potential energy
9. The common emitter current amplification foctor β is given by:
   (A) $\frac{I_C}{I_E}$ (B) $\frac{I_C}{I_B}$ (C) $\frac{I_E}{I_B}$ (D) $\frac{I_B}{I_C}$
10. Energy of the 4th orbit in hydrogen atom is:
    (A) -2.51 eV (B) -3.50 eV (C) -13.6 eV (D) -0.85 eV
11. Resistance in choke is:
    (A) Large (B) Very small (C) Zero (D) Infinite
12. The unit of $\overline{E}$ is NC^{-1} and that of $\overline{B}$ is $Na^{-1}m^{-1}$ then the unit of $\frac{\overline{E}}{\overline{B}}$ is:
    (A) ms^{-2} (B) $m^{-1}s^{-1}$ (C) ms (D) ms^{-1}
13. X-rays are the electromagnetic radiations having the wavelength in range:
    (A) 10^{-12}m (B) 10^{-10}m (C) 10^{-8}m (D) 10^{-6}m
14. To construct a step up transformer:
    (A) $N_s > N_p$ (B) $N_s < N_p$ (C) $N_s = N_p$ (D) $N_s N_p = 1$
15. When a wire of resistance R is cut into two equal parts then resistance of each wire is:
    (A) Doubel (B) Half (C) Remain same (D) One forth
16. The gain of non-inverting amplifier is:
    (A) $1+\frac{R_2}{R_1}$ (B) $1+\frac{R_1}{R_2}$ (C) $\frac{-R_2}{R_1}$ (D) $\frac{-R_1}{R_2}$
17. The energy of photon is given by:
    (A) $\frac{1}{2}mv^2$ (B) V_oe (C) m_oc^2 (D) hf

LAHORE BOARD

Physics (New Scheme) (Group -I, Class 12th) Time : 2:40 Hours
Session (2019) Subjective Marks : 68

2. Write short answers to any EIGHT parts.

i. State Gauss's law and write its mathematical relation.
ii. Define electron volt and show that 1 eV=1.6x10^{-19}J.
iii. Electric lines of force never cross. Why?
iv. Do electorns tend to go to region of high potential or of low potential?
v. State Lorentz force and write its formula.
vi. Write two uses of cathode ray oscilloscope.
vii. How can you use a magnetic field to separate isotopes of chemical element?
viii. Why the resisttance of an ammeter should be very low?
ix. How the induced current can be increased?
x. What is motional emf and write its mathematical relation?
xi. Does the induced emf in a circuit depend on the resistance of the circuit? Explain.
xii. Show that ε and $\frac{\Delta\phi}{\Delta t}$ have the same units.

3. Write short answer to any EIGHT parts.

i. Define conventional current and solar cell.
ii. Define electrolysis and basic principle of electroplating?
iii. Why does the resistance of a conductor rise with temperature?
iv. Define peak value and peak to peak value of voltage or current.
v. A sinusoidal current has rms of 10A. What is the peak value?
vi. What are superconductors?
vii. What is meant by para, diamagnetic substances?
viii. What is meant by strain energy? ix. Draw the truth table of XNOR gate.
x. Why ordinary silicon diodes do not emit light?
xi. Why is the base current in a transistor very small?
xii. Define intrinsic and extrinsic semi-conductor.

4. Write short answer to any SIX parts.

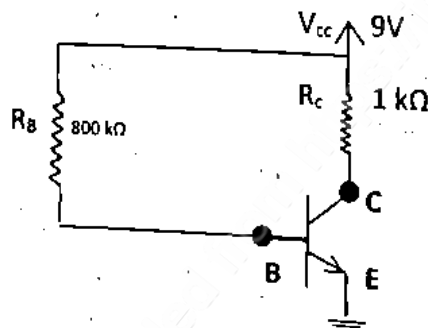
i. Will higher frequency light eject greater number of electrons than low frequency light?
ii. Photon A has twise the energy of photon B. What is the ratio of momentum of A to that of B?
iii. What is the energy of photon in a beam of infrared radiation of wavelength 1240 nm?
iv. What are the advantages of LASER over ordinary light?
v. Can the electron in ground state of hydrogen absorb a photon of energy 13.6 eV and greater than 13.6 eV?
vi. Define the isotopes of an element. Write down the isotopes of Hydrogen.
vii. What is radioactive decay? Give an example.
viii. What factor does make a fusion reaction difficult to achieve?
ix. How can radioactivity help in the treatment of cancer?

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5. (a) State Gauss's law and apply it to find electric field intensity due to an infinite sheet of charge.
(b) A platinum wire has resistance of 10Ω at 0°C and 20Ω at 273°C. Find the value of temperature co-efficeint of resistance.

6. (a) Define galvanometer. How it is converted into an ammeter and voltmeter?
(b) A pair of adjacent coils has a mutual inductance of 0.75 H. If the current in the primary changes from 0 to 10 A in 0.025 s, what is the average induced emf in the secondary? What is the change in flux in it, if the secondary has 500 turns?

7. (a) Discuss the behaviour of an inductor in an A.C. circuit and write an expression for the inductive reactance.
(b) In circuit as shown in fig. there is negligible potential drop between B and E. If β is 100, calculate: (a) base current (b) Collector current (c) potential dorp across R_c (d) V_{CE}.

8. (a) Write down the postulates of special theory of relativity. Discuss the relation of time dilation, length contraction,, mass variation and energy-mass relation with reference of this theory.
(b) A 1.0 m long copper wire is subjected to stretching force and its length increased by 20cm. Calculate the percent elongation which the wire undergoes.

9. (a) What are inner shell transistions? Discribe the production of X-rays and their uses.
(b) How much energy is absorbed by a man of mass 80 kg who receives a lethal whole body equivalent of does of 400 rem in the form of lwo energy neutrons for which RBE factor is 10?

RAWALPINDI BOARD

Physics (New Scheme) (Group – I –Class 12th) Time : 20 Minutes
Session (2019) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **If the charges are doubled and the distance between them is also doubled, then Coulomb's force will be:**
   (A) Double (B) Halved (C) Remains same (D) Four times
2. **A rubber bal of radius 2cm has a charge of 5 μc on its surface, which is uniformly distributed the value of $\vec{E}$ at its centre is:**
   (A) $10NC^{-1}$ (B) Zero (C) $2.5\ NC^{-1}$ (D) $5x10^{-6}NC^{-1}$
3. **Which one of the following relation is correct?**
   (A) joule=volt x ampere (B) joule –coulomb/volt
   (C) Joule = volt/ampere (D) Joule = coulomb x volt
4. **In carbon resistors, which colour band dindicates the tolerance of ±10%?**
   (A) White (B) Silver (C) Gold (D) Violet
5. **For an open circuit, terminal potential difference 'Vt' is:**
   (A) Vt=2emf (B) Vt=emf (C) Vt>emf (D) Vt<emf
6. **An electron travelling at 10^6m/s enters parallel in a magnetic field of 1 tesla, the magnetic force acting on it is:**
   (A) zero (B) 10^{-12}N (C) 10^3N (D) $1.6x10^{-13}$N
7. **When a charged particle is projected opposite to the direction of magnetic field, it experiences a force equl to:**
   (A) quB cosθ (B) quB sin90° (C) quB (D) zero
8. **In order to increase the range of voltmeter R_H is:**
   (A) Increased (B) Decreased (C) Unchanged (D) Increased bty 4 times
9. **Which device permits the flow of D.C?**
   (A) Capacitor (B) Photocell (C) Inductor (D) Transformer
10. **For an ideal step up transformer:**
    (A) $N_p>N_s$ (B) $N_sI_s>V_pI_p$ (C) $V_S<V_p$ (D) $I_S<I_P$
11. **When a metal detector comes close to a metal then its frequecy:**
    (A) becomes double (B) Remains same (C) Becomes half (D) Increases
12. **In RLC series circuit, at higher frequencies:**
    (A) $X_L = X_C$ (B) $X_L > X_C$ (C) $X_L < X_C$ (D) $X_L = 0$
13. **Which one belongs to trivalent group?**
    (A) Aluminium (B) Antimoney (C) Phosphorous (D) Arsenic
14. **Colour of light emitted by LED depands upon:**
    (A) Its forward biasing (B) Its reverse biasing
    (C) type of material (D) Forward current
15. **At low temperature, a body emits readiations of:**
    (A) Shorter wavelength (B) Longer wavelength
    (C) High frequency (D) High frequency & shorter wavelength
16. **The shortest wavelength in Lyman series is equal to:**
    (A) R_H (B) $\frac{R_H}{2}$ (C) $\frac{1}{R_H}$ (D) $\frac{2}{3}R_H$
17. **In the reaction, $X + {}^{17}_{8}O \rightarrow {}^{14}_{7}N + {}^{4}_{2}H_e$, X is:**
    (A) ${}^{1}_{1}H$ (B) ${}^{2}_{1}H$ (C) ${}^{0}_{1}e$ (D) ${}_{-1}^{0}e$

RAWALPINDI BOARD

(Inter Part-II, Class 12th)

Physics (New Scheme) **Subjective** **Time : 2:40 Hours**
Marks : 68

Session (2019)

2. Write short answers to any EIGHT parts.

i. What is capacitor? Define the capacitance.
ii. Write in detail about electron Volt.
iii. How can you identify that which plate of a capacitor is positively charged?
iv. If a point charge 'q' of mass 'm' is released in a non-uniform electric field with field lines pointing in the same direction will it make a rectlinear motion?
v. Define magnetic flux and mention the factors upon which it depends.
vi. Write down the uses of C.R.O
vii. Why the voltmeter should have a very high resistance?
viii. Is it possible to orient a current loop in uniform magnetic field such that the loop will not tend to rotate?
ix. State Faraday's law of electromagnetic induction and write its mathematical expression.
x. What is D.C motor? Write down the parts of D.C motor.
xi. Can a D.C motor be turned into D.C generator? What changes are required to be done?
xii. Does the induced emf always act to decrease the magnetic flux through a circuit.

3. Write short answer to any EIGHT parts.

i. Define ohm's law. Also define ohmic and non-ohmic devices.
ii. What is wheat stone bridge? Sketch its circuit diagram?
iii. Why does the resistance of a conductor rise with temperature?
iv. Write two properties of parallel resonance circuit.
v. How does doubling the frequency affect the reactance of:
(a) an inductor (b) a capacitor
vi. A sinusoidal current has rms value of 10 A. What is the maximum or peak value?
vii. Define retantivity and coercivity.
viii. Distinguish between crystalline and amorphous solids?
ix. Distinguish between instrinsic and extrinsic semi-conductor.
x. What is photodiode? Write down its any two applications.
xi. Why charge carrier is not present in the depletion region?
xii. What is the effect of forward and reverse biasing of a diode on the width of depletion region?

4. Write short answer to any SIX parts.

i. Define pair production and annihilation of matter.
ii. Which has the lower energy quanta? Radio wave or X-rays.
iii. Is it possible to create a single electron from energy? Explain.
iv. Is energy conserved when an electron emits a photon of light?
v. Define normal population and population inversion.
vi. How can radioactivity help in the treatment of cancer?
vii. A particle which produces more ionization is less penetrating. Why?
viii. Why are heavy nuclei unstable? ix. What are the basic forces in nature?

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5. **(a)** State Gauss's Law. Derive a relation for electric intensity at a point near an infinite sheet of charge.
(b) A rectangular bar of iron is 2.0cm by 2.0cm in corss-section and 40cm long. Calculate its resistance if the resistivity of iron is $11 \times 10^{-8}\Omega m$.

6. **(a)** What is mutual induction? Derive a relation for induced emf in secondary coil. What is unit of mutual inductance? Define it.
(b) A 20cm wire carrying a current of 10.0A is placed in a uniform magnetic field of 0..30T. If wire makes an angle of $40^0$with the direction of magnetic field, find the magnitude of the force acting on the wire.

7. **(a)** What is Transistor? Describe the use of transistor as an amplifier. Also calculate its voltage gain.
(b) What is the resonant frequency of a circuit which includes a coil of inductance 2.5H and a capacitanace of 40μF?

8. **(a)** What is meant by doping? Give the names of doped materials. How would you obtain n-type and p-type material from pure silicon? Illustrate it by Schematic diagram.
(b) A 90 KeV x-ray photon is fired at a carbon target and Compton scattering occurs. Find the wavelength of incident photon and scattered photon for scattering angle of 60^0.

9. **(a)** Write down the postulates of Bohr atom model for hydrogen atom. Also derive the formula for nth orbit radius of Bohr atom model and prove that the Bohr radii are quantized.
(b) A sheet of lead 5.0mm thick reduces the intensity of beam of $\gamma - rays$ by a factor 0.4. Find half value thickness of lead sheet which will reduce the intensity to half of its initial value.

Answers (Sahiwal Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
D	A	B	A	A	D	C	A	B	D	A	B	D	C	B	B	C

Answers (D.G. Khan Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
B	B	D	C	A	C	D	C	A	C	D	A	B	D	C	D	A

Answers (Bahawalpur Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
C	D	A	C	B	D	C	D	C	D	D	B	D	C	D	A	D

Answers (Multan Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A	B	D	B	B	A	B	A	C	C	A	A	D	A	D	C	B

Answers (Gujranwala Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
B	B	A	A	A	C	B	B	C	D	C	A	B	D	D	A	D

Answers (Lahore Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
C	A	B	A	C	D	C	D	B	D	B	D	B	A	B	A	D

Answers (Sargodha Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
C	B	C	C	A	A	B	D	A	D	C	D	A	D	B	C	C

Answers (Faisalabad Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
B	B	D	A	C	D	A	B	C	D	A	A	C	C	D	B	A

Answers (Rawalpindi Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
C	B	D	B	B	A	D	A	C	D	D	B	A	C	B	C	A

Board Papers 2021

SAHIWAL BOARD

Physics (New Scheme) **(Group –I –Class 11th)** **Time : 20 Minutes**
Session (2021) **Objective** **Marks : 17**

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. For an inductor connected to an A.C. source, the applied voltage:
(A) leads the current (B) is in phase with current
(C) lags the current (D) changes independently

2. The power dissipated in A.C. circuit is given by $P = I_{rms} \times V_{rms} \cos\theta$, in this relation $\cos\theta$ is called:
(A) phase factor (B) gain factor (C) loss factor (D) power factor

3. The curie temperature for iron is about:
(A) 100°C (B) 750°C (C) 900°C (D) 1150°C

4. The reverse current through a semiconductor diode is due to flow of:
(A) holes (B) electrons (C) majority carriers (D) minority carriers

5. A light emitting diode emits light only when it is:
(A) OFF (B) reverse biased (C) forward biased (D) Unbiased

6. Momentum of photon is given by:
(A) $\frac{h\lambda}{c}$ (B) $\frac{f\lambda}{c}$ (C) $\frac{hf}{c}$ (D) $\frac{hf}{\lambda}$

7. Compton shift equals the Compton wavelength, if the scattered X-ray photons are observed at:
(A) 180° (B) 90° (C) 60° (D) 45°

8. Orbital angular momentum of an electron in the allowed stationary orbit of hydrogen atom is given by:
(A) $\frac{nh}{2\pi}$ (B) $\frac{2h}{n\pi}$ (C) $\frac{2\pi}{nh}$ (D) $\frac{2n}{\pi h}$

9. The unit of decay constant is:
(A) m (B) S^{-1} (C) m^{-1} (D) S

10. Total number of quarks is:
(A) 3 (B) 4 (C) 5 (D) 6

11. Self-inductance of a solenoid having Length "l" number of turns per unit length "n" and area of cross-section "A" is given by:
(A) n^2Al (B) $\mu_o nAl$ (C) $\mu_o n^2 Al$ (D) $\mu_o n A^2 l$

12. One henry is equal to:
(A) $Vs^{-1}A^{-1}$ (B) $Vs^{-1}A$ (C) VsA (D) VsA^{-1}

13. When a charged particle is projected at right angle to the magnetic field, the magnitude of the magnetic force on charged particle is:
(A) infinite (B) maximum (C) zero (D) negligible

14. The value of permeability of free space is:
(A) $4\times10^{-7} WbA^{-1}m^{-1}$ (B) $4\times10^{7} WbA^{-1}m^{-1}$
(C) $4\pi\times10^{-7} WbA^{-1}m^{-1}$ (D) $4\pi\times10^{7} WbA^{-1}m^{-1}$

15. SI unit of conductivity is:
(A) $mho\ m^{-1}$ (B) Siemen (C) $\Omega\, m$ (D) $\Omega\, K^{-1}$

16. A capacitor is a device that can:
(A) generate charge (B) store charge
(C) neutralize charge (D) burn charge

17. Electric flux through a surface enclosing a charge depends on:
(A) charge only (B) medium only
(C) shape of closed surface (D) medium and charge enclosed

SAHIWAL BOARD

Physics (New Scheme) (Group -I, Class 11th) Time : 2:40 Hours
Session (2019) Subjective Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.
   i. Is it true that Gauss's law states that the total number of lines of forces crossing any closed surface in the outward direction is proportional to the net positive charge enclosed within surface?
   ii. Define the term time constant.
   iii. How can you identify that which plate of a capacitor is positively charged?
   iv. Sketch the graphs for charging and discharging of a capacitor.
   v. Is it possible to orient a current loop in a uniform magnetic held such that loop will not tend to rotate? Explain.
   vi. Suppose that a charge q is moving in a uniform magnetic field with a velocity V. Why is there no work done by the magnetic force that acts on the charge q?
   vii. Discuss the extension of right hand rule to find the direction of magnetic force on a current curryìng conductor.
   viii. What is the working principle "CRO"?
   ix. Does the induced emf always act to decrease the magnetic flux through a circuit?
   x. Define Faraday's law and Lenz's law.
   xi. In a certain region the earth's magnetic field point vertically down. When a plane flies due north, which wingtip is positively charged?
   xii. Name the factors upon which the self-inductance depends.
3. Write short answer to any EIGHT parts.
   i. What is Wheatstone bridge? How can it he used to determine an unknown resistance?
   ii. Why does the resistance of conductor rise with temperature?
   iii. State Kirchhoff's current and voltage rule.
   iv. Name the de vice that will permit flow of alternating current but not the direct current.
   v. How many times per second will an incandescent lamp reach maximum brilliance when connected to a 50Hz source?
   vi. Define impedance and write its unit.
   vii. What is meant by strain energy? How can it be determined from the force-extension graph?
   viii. Write a short note on superconductors.
   ix. Define elastic limit and yield point.
   x. Why a photo diode is operated in reverse biased state?
   xi. Why is the base current in a transistor very small?
   xii. What is the principle of virtual ground?
4. Write short answer to any SIX parts.
   i. What is condition for pair production?
   ii. Give two statements of uncertainty principle and write its mathematical forms.
   iii. If an electron and a proton have the same de Broglie wavelength, which particle has greater speed?
   iv. What is the biological effect of X-rays?
   v. What do you mean when we say that atom is excited?
   vi. Define mass defect and binding energy.
   vii. Show that 1μ=931 MeV
   viii. A particle which produces more ionization is less penetrating. Why?
   ix. Why heavy nuclei are unstable?

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) Describe the experiment for determination of charge on an electron by Millikan's oil drop method.
(b) The resistance of an iron wire at 0°C is 1×104Ω. What is the resistance at 500°C, if the temperature coefficient of resistance of iron is 5.2 x10-3 K-1?
6.(a) Explain construction, working and uses of Cathode Ray Oscilloscope.
(b) A metal rod of length 25cm is moving at the speed of 0.5ms-1 in the direction perpendicular to a 0.25 T magnetic field. Find the emf produced in the rod.
7. (a) Explain transistor as an amplifier and derive a relation for its gain.
(b) Find the value of the current flowing through a capacitance 0.5μF when Connected to a source of 150 V at 50 Hz.
8. (a) Explain energy band theory of solids. How does it help to distinguish between conductors, insulators and semiconductors?
(b) If $^{233}_{92}U$ decays twice by α-emission, what is the resulting isotope?
9. (a) What is inner shell transitions? Explain the production of X-rays.
(b) What is the de Broglie wavelength of an electron whose kinetic energy is 120 eV?

GUJRANWALA BOARD

Physics (New Scheme) **(Group – I –Class 12th)** **Time : 20 Minutes**

Session (2021) **Objective** **Marks : 17**

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **A device which converts mechanical energy into electrical energy is called:**
(A) D.C. generator (B) D.C. motor (C) A.C. generator (D) transformer
2. **A photodiode can turn its current ON and OFF in :**
(A) $10^{-3}s$ (B) $10^{-6}s$ (C) $10^{-9}s$ (D) $10^{-12}s$
3. **The relation for the gain of an inverting amplifier is :**
(A) $G=\frac{R_1}{R_2}$ (B) $G=\frac{R_2}{R_1}$ (C) $G=\frac{-R_2}{R_1}$ (D) $G=\frac{-R_1}{R_2}$
4. **Normally an electron can reside in metastable state for about**
(A) $10^{-8}s$ (B) $10^{-6}s$ (C) $10^{-4}s$ (D) $10^{-3}s$
5. **The formula for electric field as potential gradient is.**
(A) $E=\frac{-\Delta v}{\Delta r}$ (B) $E=\frac{-\Delta v}{\Delta r}$ (C) $E=\frac{-\Delta U}{\Delta r}$ (D) $E=\frac{-\Delta U}{\Delta t}$
6. **The energy required for pair production is**
(A) 0.51 Mev (B) 1.02 Mev (C) 2.04 Mev (D) 3.06 Mev
7. **The amount of energy equivalent to 1 amu is**
(A) 9.315 Mev (B) 93.15 Mev (C) 931.5 Mev (D) 211.5 Mev
8. **The relation for self-inductance of the solenoid is**
(A) $L=\mu_o nAl$ (B) $L=\mu_o NAl$ (C) $L=\mu_o n^2 Al$ (D) $L=\mu_o N^2 Al$.
9. **In colour code for carbon resistor, if there is no fourth band, then tolerance is**
(A) $\pm 20\%$ (B) $\pm 10\%$ (C) $\pm 5\%$ (D) $\pm 4\%$
10. **Electrons are**
(A) hadrons (B) leptons (C) quarks (D) baryons
11. **In R-L series circuit, phase angle is given by**
(A) $\theta=\tan^{-1}(\omega RL)$ (B) $\theta=\tan^{-1}\left(\frac{R}{\omega L}\right)$ (C) $\theta=\tan^{-1}\left(\frac{\omega L}{R}\right)$ (D) $\theta=\tan^{-1}\left(\frac{1}{\omega RL}\right)$
12. **The relation** $\sum_{r=1}^{N}(\vec{B}.\Delta\vec{L}) = \mu_o I$ **is called as**
(A) Faraday's law (B) Lenz's law (C) Ampere's law (D) Gauss's law
13. **The SI unit of electric potential is**
(A) $Kgm^2s^{-1}c$ (B) $Kgm^2s^{-2}c$ (C) $Kgm^2s^{-2}c^{-1}$ (D) $Kgm^{-2}s^2c^{-1}$
14. **Compton wavelength is**
(A) $\frac{h}{m_o c^2}$ (B) $\frac{hc}{m_o}$ (C) $\frac{hc}{m_o c}$ (D) $\frac{hc^2}{m_o}$
15. **The capacitance required to construct a resonance circuit of frequency 1000 KHz with an inductor of 5 mH is**
(A) 5.09 PF (B) $5.09\mu F$ (C) $5.09\,mF$ (D) $5.09KF$
16. **Substances which break just after the elastic limit is reached are called ______ substances.**
(A) brittle (B) non-magnetic (C) magnetic (D) ductile
17. **The brightness of spot on the screen of CRO is controlled by**
(A) filament (B) cathode (C) anode (D) grid

GUJRANWALA BOARD

Physics (New Scheme) **(Group-I, Class 12th)** **Time : 2:40 Hours**

Session (2021) **Subjective** **Marks : 68**

2. **Write short answers to any EIGHT parts.**
i. A particle carrying a charge of 2e falls through a potential difference of 3.0 V. Calculate the energy acquired by it.
ii. Define electron volt. iii. Define electric flux. Also write down its unit.
iv. How can you identify that which plate of a capacitor is positively charged?
v. Why does the picture on a T.V screen become distorted when a magnet is brought near the screen?

vi. How can you use a magnetic field to separate isotopes of chemical element?
vii. A plane conducting loop is located in a uniform magnetic field that is directed along the x-axis. For what orientation of the loop, is the flux a maximum? For what orientation is the flux a minimum?
viii. If a charged particle moves in a straight line through some region of space, can you say that the magnetic field in the region is zero?
ix. Does the induced emf in a circuit depend on the resistance of the circuit? Does the induced current depend on the resistance of the circuit?
x. Does the induced emf always act to decrease the magnetic flux through a circuit?
xi. Is it possible to change both the area of the loop and the magnetic field passing through the loop and still not have an induced emf in the loop?
xii. Show that ε and $\Delta\varphi/\Delta t$ have the same units?

3. Write short answer to any EIGHT parts.

i. Is the filament resistance lower or higher in a 500 W, 220 V light bulb than in a 100 W, 220 V bulb?
ii. Describe a circuit which will give a continuously varying potential.
iii. What are thermistors? Write down their applications.
iv. How many times per second will an incandescent lamp reach maximum brilliance when connected to a 50 Hz source?
v. In a R-L circuit, will the current lag or lead the voltage? Illustrate your answer by a vector diagram.
vi. A 100 μ F capacitor is connected to an alternating voltage of 24 V and frequency 50 Hz. What will be the reactance of the capacitor?
vii. Define stress and strain. What are their SI units?
viii. What is meant by hysteresis loss? How is it used in the construction of transformer?
ix. Define modulus of elasticity. Show that the units of modulus of elasticity and stress are the same.
x. Why a photo diode is operated in reverse biased state?
xi. Why is the base current in a transistor very small?
xii. Define open loop gain and write down its relation.

4. Write short answer to any SIX parts.

i. Define pair production and write down its equation.
ii. What happens to total radiation from a black body if the absolute temperature is doubled?
iii. Which photon red, green or blue carries the most (a) Energy and (b) Momentum?
iv. Write down two uses of Laser in Medicine.
v. What do we mean when we say that the atom is excited?
vi. What do we mean by the term critical mass?
vii. Describe a brief account of interaction of various types of radiations with matter.
viii. Define half-life of a radioactive element, write down its expression.
ix. What is radioactivity?

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5. (a) What is a wheatstone bridge? How is it used to determine an unknown resistance?
(b) Compare magnitudes of electrical and gravitational forces exerted on an object (mass = 10.0 g, charge = 20.0 μC) by an identical object that is placed 10.0 cm from the first. (G=6.67x $10^{-11} Nm^2kg^{-2}$)

6. (a) Discuss the principle, construction and working of an alternating current generator. Also find expression for induced emf and current.
(b) Find the radius of an orbit of an electron moving at a rate of $2.0\times10^{7} ms^{-1}$ in a uniform magnetic field $1.20\times10^{-3}T$.

7. (a) Explain R-L-C series resonance circuit. Draw its impedance diagram and also write down its properties.
(b) In a certain circuit, the transistor has a collector current of 10 mA and base current of $40\mu A$. What is the current gain of the transistor?

8. (a) What are radiation detectors? Describe the principle, construction and working of Wilson Cloud Chamber for detecting nuclear radiation.
(b) The length of a steel wire is 1.0 m. and its cross-sectional area is $0.03\times10^{-4}m^2$. Calculate the work done in stretching the wire when a force of 100 N is applied within the elastic region. Young's modulus for steel is $3.0\times10^{11} Nm^{-2}$.

9. (a) What is LASER? Describe its principle and operation.
(b) An electron is placed in a box about the size of an atom that is about $1.0\times10^{-10}m$. What is the velocity of the electron?

D.G KHAN BOARD

Physics (New Scheme) **(Group – I –Class 12th)** **Time : 20 Minutes**

Session (2021) **Objective** **Marks : 17**

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. A particle of charge 2 e falls through potential difference of 3.0 V will have energy
(A) 1.5 eV (B) 0.66 eV (C) 6 eV (D) 12 eV

2. The minimum value of charge on free particle is
(A) $\frac{2}{3}e$ (B) $\frac{1}{3}e$ (C) $\frac{-2}{3}e$ (D) e

3. The SI unit of conductance is
(A) Siemen (B) Ohm (C) Henry (D) Weber

4. In the expression $\frac{e}{m}=\frac{V}{Br}$, the radius is measured by making electronic trajectory
(A) Hyperbolic (B) Ellipse (C) Dark (D) Visible

5. Output waveform of built-in voltage of the CRO is
(A) Sinusoidal (B) Square (C) Rectangular (D) Saw tooth

6. The Lenz's law is also a statement of law of conservation of
(A) Charge (B) Parity (C) Mass (D) Energy

7. The principle of A.C generator is
(A) Lenz's law (B) Faraday's law (C) Mutual induction (D) Coulomb's law

8. In A.C through resistance, current and voltage are
(A) in phase (B) out of phase (C) current leads (D) 90° phase difference

9. The unit of $\frac{WL}{R}$ in R - L series circuit is
(A) Ohm (B) Volt (C) Henry (D) Unitless

10. The most suitable metal for making permanent magnet is
(A) Iron (B) Steel (C) Silver (D) Copper

11. Base of the transistor is very thin of the order of the
(A) $10^{-6}m$ (B) $10^{-2}m$ (C) $10^{-1}m$ (D) $10^{-3}m$

12. The operational amplifier, when works as inverting amplifier. The phase change between its input and output is
(A) 90° (B) 120° (C) 150° (D) 180°

13. The factor $\frac{h}{m_o c}$ has the unit of
(A) Kilogram (B) Second (C) Meter (D) Joule

14. Which properties of radio waves are predominate?
(A) Wave (B) Particle (C) Partial wave (D) Partial particle

15. Finely focused beam of laser has been used to destroy
(A) Crystal structure (B) Cancerous cells (C) Weapons (D) Germs

16. Baryon with combination of up , up and up quark has charge
(A) 1 e (B) 2 e (C) -1 e (D) -2 e

17. $_1^2H+_1^2H\rightarrow_1^3H+X+4.0$ Mev. The particle X is:
(A) $_0^1n$ (B) $_1^1H$ (C) $_1^2H$ (D) electron

D.G KHAN BOARD

physics (New Scheme) (Group-I, Class 12th) Time : 2:40 Hours
Session (2021) Subjective Marks : 68

2. Write short answers to any EIGHT parts.

i. Show that : $1\frac{volt}{meter} = 1\frac{newton}{coulomb}$.
ii. Two opposite point charges, each of magnitude q are separated by a distance 2d. What is the electric potential at a point P mid-way between them?
iii. Is E necessarily zero inside a charged rubber balloon if balloon is spherical? Assume that charge is distributed uniformly over the surface.
iv. Is it true that Gauss's law states that the total number of lines of forces crossing any closed surface in the outward direction is proportional to the net positive charge enclosed within surface?
v. The magnetic field in a certain region is given by $\vec{B} = \left(40\hat{i} - 18\hat{k}\right)\ wbm^{-2}$. How much flux passes through a $5.0cm^2$ area loop in this region if the loop lies flat in the XY-plane ?
vi. Prove that $\vec{F} = q\vec{E} + q\left(\vec{V} \times \vec{B}\right)$
vii. Why does the picture on a TV screen become distorted when a magnet is brought near the screen?
viii. How can a current loop be used to determine the presence of a magnetic field in a given region of space?
ix. How can an induced current be increased?
x. Define mutual inductance and write its unit.
xi. Does the induced emf in a circuit depend on the resistance of the circuit? Does the induced current depend on the resistance of the circuit?
xii. In a certain region, the earth's magnetic field point vertically down. When a plane flies due north, which wingti s is sositively charged?

3. Write short answer to any EIGHT parts.

i. What are thermistors? For what they are used for?
ii. Do bends in a wire affect its electrical resistance? Explain.
iii. Describe a circuit which will give a continuously varying potential.
iv. What are the average values of current '1' and voltage 'V' over a cycle of alternating current? What are the average values of I^2 and V^2 over a cycle?
v. What is impedance? Give its unit.
vi. How does doubling the frequency affect the reactance of (a) an inductor (b) a capacitor?
vii. What is difference between ductile and brittle substances? Give example of each.
viii. Define modulus of elasticity. Also discuss its three kinds.
ix. What is meant by para, dia and ferromagnetic substances? Give examples for each.
x. What is a light emitting diode? Give its applications.
xi. Describe the variation of size and the difference in concentration of impurity in different parts of a transistor.
xii. What is the principle of virtual ground?

4. Write short answer to any SIX parts.

i. As a solid is heated and begins to glow, why does it first appear red?
ii. Which has the lower energy quanta Radio waves or X-rays.
iii. A particle of mass 5.0 mg moves with speed of 8.0 m/s. Calculate its de-Broglie wavelength.
iv. Can X-rays be reflected, refracted, diffracted and polarized just like any other waves? Explain.
v. What is difference between spontaneous and stimulated emission?
vi. If a nucleus has a half life of 1 year, does this mean that it will be completely decayed after 2-years. Explain.
vii. What information is revealed by the length and shape of the tracks of an incident particle in Wilson Cloud Chamber?
viii. Define hadrons. Also differentiate between baryons and mesons.
ix. Define Half life and write its mathematical formula.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5. (a) By using Millikan oil drop experiment, How can the charge on electron be measured.
(b) The resistance of an iron wire at $0\,^{o}C$ is $1.0\times10^{4}\Omega$. What is the resistance at $500\,^{o}C$ if the temperature coefficient of resistance of iron is $5.2\times10^{-3}K^{-1}$?

6. (a) What is cathode Ray Oscilloscope? Explain the functions of (i) Cathode (ii) Grid (iii) Anodes (iv) Deflecting plates and (v) Sweep generator.
(b) A solenoid has 250 turns and its self inductance is 2.4 mH. What is the flux through each turn when the current is 2A? What is the induced emf when the current changes at $20AS^{-1}$?

7. (a) What is p-n junction? Describe forward and reverse biased p-n junction. Discuss the characteristics curves in short.

   (b) Find the value of the current flowing through a capacitance $0.5\,\mu F$ when connected to a source of 150 V at 50 Hz.

8. (a) Write a brief note on nuclear fission.
   (b) A 1.25 cm diameter is subjected to a load of 2500 kg. Calculate the stress on the bar in mega-Pascals.

9. (a) Explain photoelectric effect on the basis of classical and quantum theory.

   (b) The wave length of K X-ray from copper is $1.377\times10^{-10}\,m$. What is the energy difference between two levels from which this transition results?

SARGODHA BOARD

Physics (New Scheme) (Group – I –Class 12th) Time : 20 Minutes
Session (2021) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **In which nuclear detector, visible path of ionizing particle is shown:**
   (A) Wilson cloud chamber (B) GM Counter
   (C) Solid State detector (D) All of these
2. **The binding energy per nucleon is:**
   (A) Greatest for heavy nuclei (B) Least for heavy nuclei
   (C) Greatest for light nuclei (D) Greatest for medium weight nuclei
3. **A parallel plate capacitor with oil between the plate $\left(\sum r = 2\right)$ has a capacitance C. If the oil is removed then capacitance of capacitor becomes.**
   (A) C (B) $\frac{C}{2}$ (C) $\frac{C}{\sqrt{2}}$ (D) $\sqrt{2C}$
4. **An ECG records the __________ between points on human generated by electrical process in the heart.**
   (A) Heart beat (B) Pulse rate (C) Voltage (D) Pressure
5. **If the length of the conductor is doubled and its cross sectional area is halved, its conductance will**
   (A) Increases four times (B) Becomes one-fourth
   (C) Becomes-half (D) Remains unchanged
6. **For a current carrying solenoid the term 'n' has unit as**
   (A) No unit (B) m (C) m^{-1} (D) m^{-2}
7. **Two long parallel wires carrying current in the same direction:**
   (A) Attract (B) Repel (C) Turn (D) No effect
8. **The current in a coil changes from 0 to 2 A in 0.05 s. If the induced emf is 80 V, the self inductance of the coil is**
   (A) 1 H (B) 0.5 H (C) 1.5 H (D) 2 H
9. **Maximum motional emf in a conductor is given by VBL. At which angle the conductor moves in magnetic field such that emf in it becomes half then its maximum value is**
   (A) $0^{\circ}C$ (B) 30° (C) 45° (D) 60°
10. **At high frequency the current through a capacitor of A.C. Circuit will be**
    (A) Large (B) Small (C) Infinite (D) Zero
11. **With increase in frequency of an A.C. supply, the impedance of RLC series circuit.**
    (A) Decreases (B) Increases
    (C) Remains constant (D) 1st decrease, become minimum and then increase
12. **Curie temperature for iron is about**
    (A) 750 K (B) 570 K (C) 1023 K (D) 670 K
13. **If R_1 = infinity and R_2 = 0, then gain of non-inverting amplifier is**
    (A) 0 (B) 1 (C) 2 (D) Infinity
14. **The term transistor Stands for**
    (A) Transfer of resistance (B) Transfer of voltage
    (C) Transfer of current (D) All of these
15. **In the equation $\Delta\lambda = \frac{h}{m_o c}(1-\cos\theta)$ which factor is called Compton wavelength**
    (A) $\frac{h}{m_o c}$ (B) $\frac{1}{m_o c}$ (C) $(1-\cos\theta)$ (D) $\frac{h}{m_o c}(1-\cos\theta)$
16. **In photoelectric effect if the intensity of light is made twice than initial value. The maximum K.E of photoelectron becomes**
    (A) Same (B) Double (C) Half (D) Four times
17. **The energy of the 4th orbit in hydrogen atom is**
    (A) $-13.6\,ev$ (B) $-0.85\,ev$ (C) $-3.40\,ev$ (D) $-1.51\,ev$

SARGODHA BOARD

Physics (New Scheme) (Group-I, Class 12th) Time : 2:40 Hours
Session (2021) Subjective Marks : 68

2. Write short answers to any EIGHT parts.
i. Is E necessarily zero inside a charged rubber balloon if balloon is spherical? Assume that charge is distributed uniformly over the surface?
ii. How can you identify that which plate of a capacitor is positively charged?
iii. State Gauss's law and write mathematical expression.
iv. Write four properties of electric field lines.
v. How can a current loop be used to determine the presence of a magnetic field in a given region of space?
vi. Why does the picture on a TV screen become distroted when a magnet is brought near the screen?
vii. State Ampere's circuital law and write its mathematically expression.
viii. What is CRO? Write only its main parts.
ix. Show that $\in$ and $\frac{\Delta\phi}{\Delta t}$ have the same unit.
x. Does the induced emf always act to decrease the magnetic flux through a circuit?
xi. Define mutual inductance and write its unit.
xii. Write the factors upon which self inductance depends?

3. **Write short answer to any EIGHT parts.**
i. What is thermistor?
ii. Under what conditions, The emf of a cell and terminal potential are same.
iii. Explain why the terminal potential of a battery decreases when the current drawn from it is increased.
iv. In R-L circuit, will the current lag or lead? Illustrate your answer by a vector diagram.
v. Deline instantaneous and peak value of current.
vi. Write down two properties of RLC parallel circuit.
vii. What is meant by Hystersis loss? How is it used in the construction of a transformer.
viii. Discuss the mechanism of electrical conduction by holes and electrons in semiconductor element.
ix. What is difference between Elasticity and plasticity.
x. Why is the base current is very small?
xi. The anode of a diode is 0.2 V positive with respect to its cathode. Is it forward biased.
xii. Define current gain of a transistor. Give its unit.

4. **Write short answer to any SIX parts.**
i. Which photon, red, green, oy blue carries the most. (a) energy and (b) momentum
ii. Will bright light ejects more electrons from a metal surface than dimmer light of the same colour'?
iii. Define Stefen's Boltzmann Law. Also give the value of Stefen's constant.
iv. Can X-ray be reflected, refracted, diffracted and polarized just like any other wave? Explain.
v. Explain why laser action cannot occur without population inversion between atomic levels?
vi. What do we mean by the term critical mass?
vii. A particle which produces more ionization is less penetrating. Why?
viii. If someone accidently swallows an α-source and β-source. Which would be the more dangerous to him? Explain why?
ix. Define the terms mass defect and binding energy.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5. (a) Explain in detail, electrical power and power dissipation in resistor.
(b) The time constant of a series RC. circuit is t=RC. Verify that an ohm times farad is equivalent to second.

6. (a) Derive an expression for torque on current carrying coil in uniform magnetic field.
(b) A coil of 10 turns and 35 cm area is in a perpendicular magnetic field of 0.5 T. The coil is pulled out of the field in 1.0 s. Find the induced emf in the coil as it is pulled out of the field.

7. (a) What is operational amplifier? How op. Amplifier is used as Non Inverting Amplifier?
(b) A 10 mH, $20\,\Omega$ coil is connected across 240 V and $180/\pi$ Hz source. How much power does it dissipate.

8. (a) What are intrinsic and extrinsic semi conductors? Describe the formation of N-type and P-type semi conductors.
(b) If ${}^{233}_{92}U$ decays twice by α-emission; what is the resulting isotope?

9. (a) State Postulates of Bohr's model of Hydrogen atom and show that hydrogen atom has quantized radii.
(b) An electron is accelerated through a potential difference of 50 V calculate its de-Broglie wave length.

BAHAWALPUR BOARD

Physics (New Scheme) **(Group –I –Class 12th)** **Time : 20 Minutes**
Session (2021). **Objective** **Marks : 17**

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **The Gradient of the scalar Field is always be a:**
   (A) Scalar Quantity (B) Vector Quantity
   (C) Variable Quantity (D) Fixed Quantity
2. **Work done by Magnetic force on a charge particle while moving through magnetic field is:**
   (A) qvB (B) vB/q (C) q/vB (D) Zero
3. **Which one of the following is used to determine internal resistance of a cell:**
   (A) Potentiometer (B) Wheat Stone Bridge
   (C) Ammeter (D) Voltmeter
4. **On removing the dielectric form a charged capacitor, its energy:**
   (A) Increase (B) Remains Unchanged
   (C) Decreases (D) None of these
5. **The Ratio of Magnetic Force (Fm) and electric Force (Fe) acting on a charge moving undeflected through the field is:**
   (A) E/B (B) B/E (C) 1 (D) E/vB
6. **The emf induced in 1 mH inductance in which current changes from 5A to 3A in 1ms is:**
   (A) 2×10^{-6} (B) 8×10^{-6} (C) 2V (D) 8V
7. **The inductance of Coil is proportional to:**
   (A) Its shape (B) The number of turns
   (C) The Resistance Coil (D) The square of the number of turns
8. **In a A.C. Circuit, a Resistance R is connected in Series with an inductance L if phase angle between voltage and current be 45°, the value of inductive reactance will be:**
   (A) 2R (B) R (C) R/2 (D) R/4
9. **An A.C. varies as a function of:**
   (A) Time (B) Current (C) Voltage (D) Displacement
10. **In common Emitter Transistor Amplifier the input signal and output signal are always:**
    (A) Have the same Magnitude (B) Have same phase
    (C) Out of the phase by 180° (D) Negative
11. **The value of input Resistance of OP-Amplifier is of the order of:**
    (A) Few Ohms (B) Milli Ohms (C) Kilo Ohms (D) Mega Ohms
12. **Very weak magnetic field produced by brain can be detected by:**
    (A) MRI (B) Metallic Needle (C) Squids (D) Cat scanner
13. **Who gave the idea of Matter waves:**
    (A) de-Broglie (B) Einstein (C) Huygen (D) Max-planck
14. **Dead Time of G.M. Counter is approximately:**
    (A) 10^{-6}s (B) 10^{-5}s (C) 10^{-4}s (D) 10^{-3}s
15. **In order to increase the stopping potential of ejected photoelectrons, there should be an increase in:**
    (A) Intensity of Radiation (B) wavelength of Radiation
    (C) Frequency of radiation
    (D) Both wavelength of radiation and intensity of radiation
16. **Leptons are particles do not experience:**
    (A) Strong Nuclear Force (B) Weak Nuclear Froce
    (C) Electric Force (D) Magnetic Force
17. **Which of the following is the energy required (in ev) for ionizing an exited Hydrogen atom:**
    (A) 13.6 ev (B) 10.2 ev
    (C) More than 13.6 ev (D) 3.4 ev less than it

BAHAWALPUR BOARD

Physics (New Scheme) (Group -I, Class 12th) Time : 2:40 Hours
Session (2021) Subjective Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.

i. If a point charge q of mass m is released in a non - uniform electric field with field lines pointing in the same direction, will it make a rectilinear motion?
ii. Do Electrons tend to go to region of High Potential or of low Potential?
iii. Show that V/m is equal to N/C
iv. A particle carrying a charge of 5e falls through a potential difference of 2V. Calculate the energy acquired by it.
v. How can you use a magnetic field to separate isotopes of chemical element?
vi. Is it possible to orient a current loop in a uniform magnetic field such that the loop will not tend to rotate? Explain.
vii. Define Magnetic Flux Density and write its unit.
viii. What is CRO? Write two uses of CRO.
ix. How would you position a flat loop of wire in a changing magnetic field so that there is no emf induced in the loop?
x. Is it possible to change boric the area of the loop and the magnetic field passing through the loop and still not have an Induced emf in the loop?
xi. State Faraday's law of Electromagnetic Induction and write its mathematical expression.
xii. Define Self Inductance and also define its unit.

3. Write short answer to any EIGHT parts.

i. What are Non-Ohmic Substance? Give two examples.
ii. A Voltmeter cannot read the exact end of the cell, Why?
iii. Why does the resistance of a conductor rise with temperature?
iv. What is Impedance?
v. A Sinusoidal has rms value of 10 A. What is the maximum value?
vi. How does doubling the frequency affect the reactance of:
(a) An Inductor (b) A Capacitor
vii. Distinguish between Ductile and Brittle Substances.
viii. Energy Dissipated per cycle is more for steel as compared to iron, why?
ix. What are Super Conductors?
x. Give four applications of a photodiode.
xi. Define Open Loop gain of Operational Amplifier.
xii. Why Ordinary Silicon Diode does not emit light?

4. Write short answer to any SIX parts.

i. A Beam of Red Light and a Beam of Blue Light have exactly the same energy. Which Beam contains the greater number of photons?
ii. Why don't we observe a Compton Effect with Visible Light?
iii. What are Black Body Radiations and how can you get a Black Body?
iv. Bohr's Theory of Hydrogen atom is based upon several assumptions. Do any of these assumptions contradict classical physics?
v. What are the advantages of Laser over Ordinary Light?
vi. Describe the principle of Operation of a Solid State Detector of ionizing radiation in terms of generation and detection of charge carriers.
vii. Discuss the advantages and disadvantages of fission power from the point of safety, pollution and resources.
viii. Differentiate between Baryons and Mesons.
ix. Define Absorbed Dose D and write down its unit.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) State Gauss's Law. Using the concept of Gaussian Surface, derive the formula of Electric intensity due to an infinite sheet of charge?
(b) 0.75 A current flows through an Iron wire when a battery of 1. 5 V is connected across its ends. The length of the wire is 5.0 m and cross sectional area is 2.5 x 10-7 m2. Compute Resistivity of Iron.

6.(a) What is an Alternating Current Generator? Describe its principle, construction and working. Also derive an expression for Induced end and induced current.
(b) You are asked to design a Solenoid that will give a magnetic field of 0.10 T, yet the current must not exceed 10.0 A . Find the number of turns per unit length that the Solenoid should have.

7. (a) What is Rectification Explain Full Wave Rectification with circuit Diagrams.
(b) An Iron core coil of 2.0 H and 50Ω is placed in series with a resistance of 450Ω. An A.C. supply of 100 V, 50 Hz is connected across the circuit. Find:
The Current Flowing in the Coil (ii) Phase angle between the Current and Voltage.

8. (a) Describe the construction and working of a Solid Slats Detector. What are its merits over other Detectors?
(b) A 1.25 cm Diameter Cylinder is subjected to a load of 2500 Kg. Calculate the stress on the bar in Mega Pascals.

9. (a) Derive the relation for the Quantized Radii of Hydrogen Atom on the Basis of Bohr's Model of Hydrogen Atom.
(b) An Electron is placed in a box about the site of an atom 1.0 x10-10m. What is the velocity of the Electron?

LAHORE BOARD

Physics (New Scheme) **(Group –I –Class 12th)** **Time : 20 Minutes**
Session (2021) **Objective** **Marks : 17**

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **The critical temperature of mercury is:**
(A)1.18k (B) 4.2 K (C) 3.72K (D) 7.2 K
2. **The energy stored in inductor is:**
(A) ½ LI^2 (B) 1/2LI (C) $1/2L^2I$ (D) $1/2L^2I^2$
3. **The value of plank's constant h is:**
(A)6.63×10^{-34} Js (B) 6.63×10^{-34}J/s (C) 6.63×10^{-34} Js^2 (D) 6.63×10^{-34} J/s^2
4. **If the potential difference across two plates of capacitor is doubled, the energy in it will be:**
(A) Two times (B) Eight times (C) Four times (D) Remains same
5. **The dead time of G.M. counter is:**
(A) 10^{-3}s (B) 10^{-4}s (C) 10^{-6}s (D) 10^{-8}s
6. **At high frequency the value of reactance of capacitor will be:**
(A) Small (B) Zero (C) Large (D) Infinite
7. **The brightness of spot on CRO screen is controlled by:**
(A) Plates (B) Cathode (C) Anode (D) Grid
8. **The quantity** $-\frac{\Delta V}{\Delta r}$ **is called:**
(A) Electric potential (B) Electric energy
(C) Potential energy (D) Potential gradient
9. **The current gain β of the transistor is given by:**
(A) $\beta=\frac{I_B}{I_C}$ (B) $\beta=I_B=I_c$ (C) $\beta=I_B-I_C$ (D) $\beta=\frac{I_c}{I_B}$
10. **Radius of first Bohr orbit of hydrogen atom is:**
(A) 0.053 nm (B) 0.053mm (C) 0.053 (D) 0.053 m
11. **When 10V are applied to an A.C. circuit, the current flowing in it 100 mA, its impedance is:**
(A) 10 Ohm (B) 100 Ohms (C) 1000 Ohms (D) 1 Ohms
12. **The e/m of neutron is:**
(A) Less than electron (B) Zero
(C) Greater than electron (D) The same as electron
13. **Gamma rays emitted from radioactive element have speed:**
(A) 1×10^{7} ms^{-1} (B) $1\times10^{8}ms^{-1}$ (C) $3\times10^{8}ms^{-1}$ (D) $4\times10^{19}ms^{-1}$
14. **The unit of self inductance is:**
(A) Weber (B) Tesla (C) Henry (D) Farad
15. **Kirchhoff's second rule is a way of stating conservation of:**
(A) Mass (B) Charge (C) Energy (D) omentum
16. **The input resistance of an operational amplifier is:**
(A) Zero (B) Low
(C) High (D) Equal to output resistance
17. **Albert Einstein was awarded Noble Prize in physics in:**
(A) 1905 (B) 1911 (C) 1918 (D) 1921

LAHORE BOARD

Physics (New Scheme) (Group -I, Class 12th) Time : 2:40 Hours
Session (2021) Subjective Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.

i. If point charge q of mass m is released in a non uniform electric field with field lines pointing in the same direction, will it make a rectilinear motion?
ii. Do electrons tend to go to region of high potential or of low potential?
iii. Electric field lines provide information about the strength of the electric field. Describe electric field intensity in terms of field lines.
iv. Define and write relation for dielectric constant in terms of capacitances of a capacitor.
v. Explain the principle of extension of right hand rule.
vi. How does the graph pattern appear stationary on the screen of CRO? Explain the condition.
vii. Two charged particles are projected into a region where there is a magnetic field perpendicular to their velocities. If the charges are deflected in opposite directions, what can you say about them?
viii. If a charged particle moves in a straight line through some region of space, can you say that the magnetic field in the region is zero?
ix. What is the importance of minus sign in the expression $\varepsilon = -N\frac{\Delta \varnothing}{\Delta t}$ for Faraday's law of Electromagnetic induction?
x. Why self-induced emf is also called as back emf?
xi. Does the induced emf always act to decrease the magnetic flux through a circuit?
xii. Is it possible to change both the area of the loop and the magnetic field passing through the loop and still not have an induced emf in the loop?

3. Write short answer to any EIGHT parts.

i. What is Wheatstone bridge? How can it be used to determine an unknown resistance?
ii. Differentiate between resistance and resistivity.
iii. Explain why the terminal potential difference of a battery decreases when the current drawn from it is increased?
iv. How does doubling the frequency affect the reactance of : (a) An inductor (b) A capacitor
v. A sinusoidal current has rots value of 10A. What is the maximum or peak value?
vi. Explain the power dissipation in an inductor.
vii. What is meant by para, dia and ferromagnetic substances? Give examples of each.
viii. What is meant by hysteresis loss? How is it used in the construction of a transformer?
ix. Differentiate between young modulus Y and bulk modulus K.
x. Why charge carriers are not present in the depletion region?
xi. What is the principle of virtual ground? Apply it to find the gain of an inverting amplifier.
xii. What is the potential barrier of silicon and germanium?

4. Write short answer to any SIX parts.

i. As a solid is heated and begins to glow, why does it first appear red?
ii. Why don't we observe Compton Effect with visible light?
iii. What advantages an electron microscope has over an optical microscope?
iv. What are the advantages of laser over ordinary light?
v. What is Helium-Neon Laser?
vi. Why are heavy nuclei unstable?
vii. What factors make a fusion reaction difficult to achieve?
viii. Define mass defect and binding energy.
ix. What are hadrons? Give examples.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) State Gauss's law. Find out the electric intensity due to an infinite sheet of charge.
(b) 0.75 A current flows through an iron wire when a battery of 1.5 V is connected across its ends. The length of the wire is 5 m and its cross-sectional area is 2.5 x10-71172. Compute the resistivity of iron.

6.(a) Derive the expression for force on moving charge in a uniform magnetic field.
(b) An alternating current generator operating at 50 Hz has a coil of 200 turns. The coil has an area of 120 cm2. What should be the magnetic field in which the coil rotates in order to produce an emf of maximum value of 240 volts?

7. (a) How OP amplifier can be made as inverting amplifier? Explain your answer by circuit diagram.
(b) Find the value of the current and inductive reactance when A.C. voltage of 220 V at 50 Hz is passed through an inductor of 10 H.

8. (a) Explain the principle, construction and working of Geiger Mullar Counter.
(b) A 1.25 cm Diameter Cylinder Is subjected to a load of 2500 Kg. Calculate the stress on the bar in Mega Pascals.

9. (a) State postulates of Bohr's model of the hydrogen atom and then show that hydrogen atom have quantized radii?
(b) An electron is accelerated through a potential difference of 50 V. Calculate its de Broglie wavelength.

MULTAN BOARD

Physics (New Scheme) **(Group – I – Class 12th)** **Time : 20 Minutes**

Session (2021) **Objective** **Marks : 17**

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **For non-inverting amplifier, if $R_1=\infty$ ohm, $R_2=0$ ohm then gain of amplifier is:**
   (A) 2 (B) 0 (C) 1 (D) Infinite
2. **The current gain "β" of a transistor is given by:**
   (A) $\frac{I_c}{I_B}$ (B) $\frac{I_E}{I_C}$ (C) $\frac{I_B}{I_C}$ (D) $\frac{I_E}{I_B}$
3. **The rest mass of X-ray photon is:**
   (A) 1.6×10^{-19}kg (B) 9.1×10^{-31}kg (C) 1.67×10^{-27}kg (D) Zero
4. **When platinum wire is heated, it becomes white at temperature:**
   (A) 900°C (B) 1100°C (C) 1300°C (D) 1600°C
5. **The value of Rydberg constant is:**
   (A) $1.0974\times10^{7}m^{-1}$ (B) $1.0974\times10^{-7}m^{-1}$
   (C) $1.0974\times10^{11}m^{-1}$ (D) $1.0974\times10^{-11}m^{-1}$
6. **When Υ-rays are emitted, the nuclear mass of an element:**
   (A) Increases by 2 units (B) Increases by 1 unit
   (C) Decreases by 4 units (D) Does not change
7. **The particles equal in mass or greater than proton are:**
   (A) Baryons (B) Hadrons (C) Fermions (D) Mesons
8. **$\frac{\sec}{ohm}$ is equal to:**
   (A) Coulomb (B) Farad (C) Joule (D) Ampere
9. **S.I unit of electric flux is:**
   (A) NC^{-1} (B) Nm^2C^{-1} (C) NmC^{1} (D) NmC^2
10. **A thermistor is a heat sensitive:**
    (A) Resistor (B) Capacitor (C) Inductor (D) Diode
11. **S.I unit of magnetic flux density is:**
    (A) Wbm (B) Wbm^{-1} (C) Wbm^{-2} (D) Wbm^{-3}
12. **If 300 turns of wire are wound on 30cm length, then number of turns per unit length is:**
    (A) 10 (B) 20 (C) 100 (D) 1000
13. **The principle of A.C generator is:**
    (A) Mutual induction (B) Self-induction
    (C) Electromagnetic Induction (D) All of these
14. **Energy density in inductor is given by:**
    (A) $\frac{1}{2}\frac{\beta}{\mu_o}$ (B) $\frac{1}{2}\frac{\beta}{\mu_o^2}$ (C) $\frac{1}{2}\frac{\beta^2}{\mu_o^2}$ (D) $\frac{1}{2}\frac{\beta^2}{\mu_o}$
15. **The device which allows only the flow of D.C is:**
    (A) Capacitor (B) Resistor (C) Inductor (D) Generator
16. **In R.L.C series circuit resonance occurs when:**
    (A) $X_c>X_L$ (B) $X_L>X_c$ (C) $X_L>>X_c$ (D) $X_L=X_c$
17. **The Curie temperature for iron is:**
    (A) 923 K (B) 1023 K (C) 823 K (D) 723 K

MULTAN BOARD

Physics (New Scheme) (Group -I, Class 12th) Time : 2:40 Hours
Session (2019) Subjective Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.

i. Electric lines of force never cross. Explain why?
ii. If a point charge 'q' of mass m is released in an non-uniform electric field with field lines pointing in the same direction, will it make a rectilinear motion?
iii. Prove that 1 = volt / meter = newton/coulmb
iv. A particle carrying a charge of 2e falls through a potential difference of 3.0V. Find energy acquired by it.
v. How can you use a magnetic field to separate isotopes of chemical element?
vi. If a charged particle moves in a straight line though some region of space, can you say that magnetic field in the region is zero?
vii. Draw saw tooth voltage waveform and explain it.
viii. Define magnetic flux and one Tesla.
ix. Does the induced emf in a circuit depend on the resistance of the circuit?
x. How would you position a flat loop of wire in a changing magnetic field, so that there is no emf induced in the loop?
xi. A metal rod of length 25cm is moving at speed of 0.5m/s in a direction perpendicular to a 0.25T magnetic field. Find the emf produced in the rod.
xii. Define motional emf and write its mathematical expression.

3. Write short answer to any EIGHT parts.

i. Do bends in a wire affect its electrical resistance? Explain.
ii. Why does the resistance of a conductor rise with temperature?
iii. State Kirchhoff's second Rule and write its equation.
iv. In a R-L circuit will the current lag or lead the voltage? Illustrate your answer by a vector diagram.
v. How does doubling the frequency affect the reactance of (a) an inductor (b) a capacitor?
vi. Write four properties of parallel resonance circuit.
vii. Distinguish between ductile and brittle substances.
viii. Define modulus of elasticity. Show that the units of modulus of elasticity and stress are the same.
ix. Write a brief note on superconductor,
x. What is rectification, write its two types.
xi. Why is the base current in a transistor very small?
xii. Why ordinary silicon diodes do not emit light?

4. Write short answer to any SIX parts.

i. Discuss the variation of photoelectric current with the intensity of light falling on plate of photocell.
ii. Which photon, red, green or blue carries the most (a) energy and (b) momentum.
iii. What advantages an electron microscope has over an optical microscope?
iv. What are characteristic X-rays? How are they originated form the atoms?
v. Can the electron in the ground state of hydrogen absorb a photon of energy 13.eV and greater than 13.6eV?
vi. Why is the mass of a nucleus less than the total mass of constituent particles? Where is this mass lost?
vii. What is the difference between hadrons and leptons?
viii. A particle which is more ionizing is less penetrating. Why?
ix. What do you understand by "back ground radiation"? Sate two sources of this radiation.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) Derive an expression for the energy stored in the capacitor.
(b) The potential difference across a resistance of 5.0Ω. The potential falls to 1.8V. Calculate the current and the internal resistance of the battery.

6.(a) Define self-induction. Prove that in case of inductor, the energy density is directly proportional to the square of magnetic field.
(b) A power line 10m high carries a current 200A. Find the magnetic field of the wire at the ground.

7. (a) Describe A.C through R-C series circuit.
(b) In a circuit, the transistor has a current 10 mA at collector and base current 40μA. What is the current gain of the transistor?

8. (a) What are intrinsic and extrinsic semiconductors? How the P-Types and N-Type materials are formed?
(b) Calculate the energy (in MeV) released in the following fusion reaction:

$$ {}^{2}_{1}H + {}^{3}_{1}H \rightarrow {}^{4}_{2}He + {}^{1}_{0}n $$

9. (a) What is photoelectric effect? Write two results of this effect which cannot be explained by classical electromagnetic theory. Explain them on the basis of quantum theory.
(b) A tungsten target is struck by electron that have been accelerated from rest through 40kV potential difference. Find the shortest wavelength of the bremsstrahlung radiation emitted.

FAISALABAD BOARD

Physics (New Scheme) **(Group – II –Class 12th)** Time : 20 Minutes
Session (2021) **Objective** Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. At low frequency the current through a capacitor of A.C. circuit will be:
(A) Large (B) Small (C) Zero (D) Infinite

2. The induced emf primarily produced at the cost of:
(A) Internal energy (B) Chemical energy
(C) Electrical energy (D) Mechanical energy

3. The current flowing through a coil due to induced emf in it depends upon:
(A) Shape of the coil (B) Resistance of the coil
(C) Area of the coil (D) Magnetic flux

4. Force on current carrying conductor per unit length is given by:
(A) ILB sin θ (B) ILB (C) IB (D) IB sin θ

5. An electron is moving in a circle of radius 'r' in a uniform magnetic field, suddenly the field is reduced to B/2, the radius of circle now becomes:
(A) r/2 (B) r/4 (C) 2r (D) 4r

6. On increasing the length of wire specific resistance of the wire:-
(A) Increases (B) Decreases
(C) Remains unchanged (D) First increase then decrease

7. The energy stored in the capacitor is:
(A) K.E. (B) P.E. (C) Electrical K.E. (D) Electrical P.E.

8. A particle of mass m and charge q is released from rest in a uniform electric field E. The K.E. attained by particle after moving a distance 'd' is:
(A) Ed/q (B) qE^2d (C) qEd (D) qE/d^2

9. Energy needed to create an electron-hole pair in a solid state detector is:
(A) 2-3eV (B) 3-4eV (C) 4-5eV (D) 5-6eV

10. The energy released per unit mass is greater in:
(A) Fission reaction (B) Fusion reaction
(C) Chemical reaction (D) Nuclear reaction

11. Production of X-rays can be regarded as inverse of:
(A) Compton effect (B) Photoelectric effect
(C) Annihilation of matter (D) Pair production

12. Threshold wavelength for metal having work function ϕ_0 is?
(A) $\frac{\lambda}{2}$ (B) 4λ (C) 2λ (D) $\frac{\lambda}{4}$

13. Rest mass of photon is:
(A) Zero (B) Infinity (C) hf/c (D) $\frac{hc}{\lambda}$

14. Which diode is used for detection of light?
(A) Light emitting diode (B) Photo diode
(C) Photo voltaic cell (D) All these

15. The specially designed semi-conductor diode used as indicator lamp in electronic circuit are:
(A) The switch (B) Solar cells
(C) Photodiodes (D) Light emitting diode

16. Impurity atoms are doped in semi-conductor to increase:
(A) Free electrons (B) Holes (C) Conductivity (D) Resistivity

17. The inductance and capacitance behave a function of:
(A) Voltage (B) Frequency (C) Time (D) Current

FAISALABAD BOARD

Physics (New Scheme) (Group -II, Class 12th) Time : 2:40 Hours
Session (2019) Subjective Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.
i. How can you identify that which plate of a capacitor is positively charged?
ii. Do electrons tend to go to region of high potential or of low potential?
iii. State Gauss's law and write its mathematical expression.
iv. Give a comparison between electric and gravitational forces.
v. Describe the change in magnetic field inside a solenoid carrying a steady current I, if the number of turns is doubled but the length remains the same.
vi. If a charged particle moves in a straight line through some region of space, can you say that the magnetic field in the region is zero?
vii. Define magnetic flux density and write its unit.
viii. What is Lorentz forces? Write its mathematical expression.
ix. How would you position a flat loop of wire in a changing magnetic field so that there is no emf induced in the loop?
x. Does the induced emf always act to decrease the magnetic flux through a circuit?
xi. Write the factors upon which mutual inductance depends.
xii. Sate Faraday's law of electromagnetic induction and write its mathematical expression.

3. Write short answer to any EIGHT parts.
i. Why does the resistance of a conductor rise with temperature?
ii. Explain why the terminal potential difference of a battery decreases when the current drawn from it is increased?
iii. Differentiate between resistance and resistivity. Also give their units.
iv. A sinusoidal current has 'rms' value of 10A. What is the maximum or peak value?
v. In R-L circuit, will the current lag or lead the voltage? Illustrate your answer by a vector diagram.
vi. At what frequency will an inductor of inductance 1.0H have reactance of 500Ω?
vii. What is meant by hysteresis loss? How it is used in the construction of a transformer?
viii. Define modulus of elasticity. Show that unit of modulus of elasticity and stress are same.
ix. Differentiate between curie temperature and critical temperature.
x. Why charge carriers are not present in the depletion region?
xi. Why a photo diode is operated in reverse biased region?
xii. A transistor has IC = 10mA and IB = 40mA. Calculate the current gain.

4. Write short answer to any SIX parts.
i. As a solid is heated and begin to glow, why does it first appear red?
ii. Can pair production take place in vacuum? Explain.
iii. What is the energy of photon in a beam of infra-red radiation of wavelength 1240nm?
iv. Is energy conserved, when an atom emits a photon of light?
v. What is meant by CAT-Scanner?
vi. Why are heavy nuclei unstable?
vii. Describe a brief account of interaction of various types of radiations with matter.
viii. What factors make a fusion reaction difficult to achieve?
ix. What is self-quenching in working of GM-Counter?

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) Define capacitance. Also derive a relation for capacitance of a parallel plate capacitor for air and dielectric as a medium.
(b) 0.75A current flows through an iron wire with a battery of 1.5V is connected across its ends. The length of the wire is 5.0m and its cross-sectional area is 2.5 x10-7m2. Compute the resistivity of iron.

6.(a) Derive the relation of e/m of an electron.
(b) Two coils are placed side by side. An emf of 0.8V is observed in one coil when the current is changing at the rate of 200As t in the other coil. What is the mutual inductance of the coils?

7. (a) What is an operational amplifier? Derive a relation for gain of operational amplifier as inverting amplifier.
(b) Find the capacitance required to construct a resonance circuit of frequency 1000 KHz with an inductor of 5mH.

8. (a) Define and explain fusion reaction in detail.
(b) A 1.0m long copper wire is subjected to stretching force and its length increases by 20ent. kulate the tensile strain and the percent elongation which the wire undergoes.

9. (a) What is de-Broglie hypothesis? 1 low Davisson and Gentler verify it? Explain.
(b) The wavelength of K X-ray from copper is 1.377 x 10-10m. What is the energy difference between the two levels from which this transition results?

RAWALPINDI BOARD

Physics (New Scheme) **(Group –/–Class 12th)** **Time : 20 Minutes**
Session (2021) **Objective** **Marks : 17**

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **Relation for energy density in case of an inductor is:**
   (A) $\frac{B^2}{2\mu_O}$ (B) $\frac{\mu_O}{2B_2}$ (C) $\frac{B}{2\mu_o}$ (D) $\frac{B}{2\mu_o^2}$
2. **The Lenz's law is also a statement of:**
   (A) Law of conservation of momentum (B) Law of conservational of charge
   (C) Law of conservation of energy (D) Faraday's law
3. **Peak to Peak value of an alternating voltage is**
   (A) $2V_o$ (B) 0 (C) $\frac{V_o}{\sqrt{2}}$ (D) V_o
4. **In RLC series resonance circuit, the condition for resonance is:**
   (A) $X_L=X_C$ (B) $X_L<X_C$ (C) $X_L>X_C$ (d) $X_L>Z$
5. **Young's modulus of lead is:**
   (A) $1.5\times10^{19}Nm^{-2}$ (B) $7.7\times10^{9}INm^{-2}$ (C) $5.6\times10^{9}Nm^{-2}$ (D) $2.2\times10^{9}Nm^{-2}$
6. **Number of diodes used in half wave rectifier is:**
   (A) 4 (B) 3 (C) 2 (D) 1
7. **S.I unit of current gain of transistor is:**
   (A) Coulomb (B) Ampere (C) Farad (D) No unit
8. **When platinum wire is heated, it appears cherry at red:**
   (A) 1300°C (B) 1100°C (C) 900°C (D) 500°C
9. **The value of Wein's constant is:**
   (A) $2.9\times10^{3}mK$ (B) $2.9\times10^{-3}mK$ (C) 2.9 mk (D) 2.9×10^{-2} mk
10. **In Helium-Neon laser, the value of Helium is:**
    (A) 85% (B) 75% (C) 65% (D) 60%
11. **Half-life of Uranium-238 is:**
    (A) 4.5×10^{12} years (B) 4.5×10^{11} years (C) 4.5×10^{10} years (D) 4.5×10^{9} years
12. **The dead time of the counter is:**
    (A) $\sim10^{-7}S$ (B) $\sim10^{-6}S$ (C) $\sim10^{-5}S$ (D) $\sim10^{-4}S$
13. **Unit of electric flux is:**
    (A) Nm^2C^{-2} (B) Nm^2C^{-1} (C) $N^{-1}m^2C^{-1}$ (D) $Nm^{-2}C$
14. **The statement $\phi_e = \frac{1}{\varepsilon_c}Q$ was given by:**
    (A) Faraday (B) Dersted (C) Gauss (D) Coulomb
15. **Reciprocal of resistance is:**
    (A) Capacitance (B) Conductance (C) Inductance (D) Resistance
16. **Lorentz force is given by**
    (A) $\vec{F}=\vec{I}(\vec{L}\times\vec{B})$ (B) $\vec{F}=q(\vec{V}\times\vec{B})$ (C) $\vec{F}=q\vec{E}+q(\vec{V}\times\vec{B})$ (D) $\vec{F}=q\vec{E}$
17. **A power line 10m high carries a current 200A.The magnetic field of the we at the ground is:**
    (A) 4×10^{-6}T (B) 40×10^{-6}T (C) 4×10^{-4}T (D) 4×10^{-3}T

RAWALPINDI BOARD

Physics (New Scheme) **(Group -/, Class 12th)** **Time : 2:40 Hours**
Session (2019) **Subjective** **Marks : 68**

SECTION - I

2. **Write short answers to any EIGHT parts.**
   i. How can you identify that which plate of a capacitor is positively charged?
   ii. Is it true that Gauss's law states that the total number of lines of force crossing a closed surface in the outward direction is proportional to the net positive charge enclosed within surface?
   iii. Give comparison of electric and gravitational force.
   iv. Describe the process of charging of a capacitor in short.
   v. Describe the function of two sets of deflecting plates in cathode ray oscilloscope.
   vi. In an AVO meter, how can a single galvanometer perform the function of measuring current, voltage and resistance? Explain.

vii. It a charged particle moves In a straight line through some region of space, can you say that the magnetic field in the region Is zero?
viii. How can a current loop he used to determine Ito presence of a magnetic field in a given region of space?
ix. How an emf is induced in a coil placed In a constant magnetic field? (Hint: Basic principle used in electric generators)
x. What is the significance of negative sign used In Faraday's law of magnetic induction? $\varepsilon = -N\frac{\Delta\phi}{\Delta t}$
xi. In a certain region tie earth's magnetic field point vertically down. When a plane flies due north, which wing tip positively charged?
xii. Is it possible to change both the area of the loop and the magnetic held pass, through the loop and still not have art induced emf in the loop?

3. Write short answer to any EIGHT parts.

i. Explain the term phase of A.C.
ii. Describe a circuit which will give a continuously varing potential.
iii. Explain the elastic constants.
iv. How the comparison of two emfs of cells can be made?
v. Why ordinary silicon diodes do not emit light?
vi. Write down the characteristics of Op-amplifier.
vii. What is meant by Retentivity and Coercivity?
viii. Why a photodiode is operated in reversed biased state?
ix. Why does the resistance of a conductor rise with temperature?
x. Name the device that will (a) permit flow of direct urrent but oppose the flow of alternating current. (b) Permit flow of alternating current but not the direct current.
xi. When 10V are applied to an A.C circuit, the current flowing in it is 100mA.Find its impedance.
xii. Draw a stress strain curve for a ductile material and en define t e term yield point and ultimate tensile stress.

4. Write short answer to any SIX parts.

i. What do you mean by quark?
ii. Can pa production take place in vacuum? Explain.
iii. What is fission chain reaction?
iv. Define ionization energy and ionization potential.
v. Explain why LASER action cannot occur without population inversion between atomic levels?
vi. What do you understand by background radiation? State two sources of this radiation.
vii. A particle which produce more ionization is less penetrating .Why?
viii. What happens to total radiation from a black body if its absolute temperature is doubled?
ix. Define work function and threshold frequency.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) What is Wheatstone bridge? Give its principle, construction and worng. How can it be used to determine unknown resistance?
(b) A particle having a charge of 20 electrons on it falls t rough a potential difference of 100 volts. Calculate the energy acquired by it in electron volt.

6.(a) State and explain Ampere's Law. Calculate the mag -tic field due to current carrying solenoid using Ampere's Law.
(b) A solenoid has 250 turns and its self-inductance is 2.4 mH. What is the flux through each turn, when the current is 2A? What is the induced emf when the current changes at 20 AS-1?

7. (a) An alternating current is passing through R-L-C series circuit. How this circuit works as resonance circuit Discuss frequency, current graph of this circuit.

(b) In Circuit given, there is negligible potential drop between II and E. If β is 100. Calculate (i) Base current (ii) Collector current.

8. (a) Define strain energy and derive a datum rot' strain energy in a deformed materials.
(b) A sheet of lead 5mm thick reduces the intensity of it beam of Y-rays by it factor 0.4Find half value thickness of lead sheet which will reduce the intensity to half of its initial value.

9. (a) Apply uncertainty principle to an atom in order to find that an electron can never be found inside of a nucleus and it can exist in the atom but outside the nucleus.
(b) Find the speed of electron in the first Bohr orbit.

Answers (Sahiwal Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A	D	B	D	C	C	B	A	B	D	C	D	B	C	A	B	D

Answers (Gujranwala Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
C	C	C	A	A	B	C	C	A	B	C	C	C	C	A	A	D

Answers (D.G.Khan Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
C	D	A	D	D	D	B	A	D	B	A	D	C	A	B	B	B

Answers (Sargodha Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A	D	B	C	B	C	A	D	B	A	D	C	B	A	A	A	B

Answers (Bahawalpur Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
B	D	A	A	C	C	D	B	A	C	D	C	A	C	C	A	A

Answers (Lahore Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
B	A	A	C	B	A	D	D	D	A	B	B	C	C	C	C	D

Answers (Multan Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
C	A	D	D	A	D	A	B	B	A	C	D	C	D	C	D	B

Answers (Faisalabad Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
B	D	B	D	C	C	D	C	B	B	B	A	A	B	D	C	B

Answers (Rawalpindi Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A	C	A	A	A	D	D	C	B	A	D	D	B	C	B	C	A